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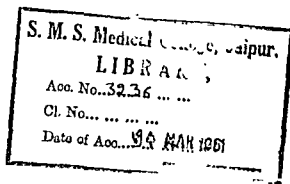
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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## DYSTOPIC KIDNEY<sup>1</sup>

By S. C. PLUMMER, M. D., Chicago

**DEFINITION.** By dystopic kidney, renal dystopia, or congenitally misplaced kidney is meant a condition in which the kidney is abnormally situated in the body, never having occupied its normal position. This is in contradistinction to movable, or floating, kidney, where a kidney has become displaced from its normal position.

The two conditions differ in the anatomy of the kidneys concerned especially as to vascularization, in clinical manifestations, in physical findings and in the indications for treatment.

According to Guizetti and Pariset (quoted by Anitschkow) (1), congenital dystopic kidney is found about once in every one thousand autopsies.

In this paper I shall not consider horseshoe kidney.

*Embryonal wandering.* Pohlman (19) explains the embryonal wandering of the kidney from the small pelvis to its normal permanent position. This process of ascent and rotation may cease at any point short of normal, or may be influenced by factors forcing the kidney from its normal course. In such a case the kidney never reaches its normal habitat, but becomes permanently fixed in an abnormal location. Alterations in size and shape frequently follow from imperfect development or from adaptation of the kidney to its anatomical environment.

Hill (10) says that "there is no vasculari-

zation of the kidney until it has reached its permanent position." If, then, this permanent position is the normal position, the renal vessels have the usual normal origin and follow the usual course, but if the permanent position is abnormal, the renal vessels originate from some near-by arterial trunk and tend to take a direct course to the kidney.

Sträter (20) says that the kidney during its embryonal wandering passes the region of several arteries and is, during this time, supplied by several vessels. If the wandering stops before the normal location is reached, these properly temporary vessels become permanent ones.

Hill's observations seem to prove the truth of his statement, but, accepting either view as to the temporary vascularization, there is no disputing the fact that the permanent vascular supply is from the vascular territory, where the kidney takes its definitive location. The vascular supply is abnormal, because the location of the kidney is abnormal, the supply adapting itself to the location of the kidney. The abnormal vascularization, being thus a secondary matter, is not a cause of renal dystopia.

*Anatomy.* In size, the dystopic kidney is generally approximately normal, although sometimes it is found to be considerably less than normal size, as in one of the specimens which I describe.

The shape is often normal, but more frequently there is some variation from the

<sup>1</sup>Read before the Chicago Surgical Society May 3, 1912 (See discussion p. 109)

normal, one of the most common variations being due to its resting on the promontory of the sacrum, the sacro-iliac joint, or linea innominata, in consequence of which a furrow or depression is found on its posterior surface. Furrows lodging the vessels are also found, as strikingly shown in the specimen from my patient. Persistence of the foetal lobulations have been noted in several cases.

The origin of the vessels supplying a dystopic kidney is always from a point lower than the normal. Frequently the artery arises from the lower portion of the aorta; the bifurcation, or point just above it, being noted as the site of origin in a considerable number of cases. In other cases the artery has arisen from the common iliac, internal iliac (hypogastric), the median sacral or the inferior mesenteric artery. I have seen no case noted where the artery took its origin from the external iliac. Anitschkow describes two cases where a left dystopic kidney received an artery from the right common iliac.

The vascular supply is in most cases a liberal one, and two or more arteries and veins are not infrequently found leading to a dystopic kidney, Meyer (15) declaring this to be the usual condition. Anitschkow (1) says a solitary artery is the exception. He describes one kidney with five arteries.

As a rule, the origin of the vessels is sufficient to distinguish a congenitally misplaced from a movable kidney. In Bissell's (3) case there was some difficulty in determining this point, because, although renal vessels of normal origin, elongated and reduced in calibre, led to the right kidney which was located in the pelvis, there were two supernumerary arteries arising from the internal iliac (hypogastric) or its branches and entering the lower pole of the kidney.

A full discussion of the vascular supply of misplaced kidneys will be found in the articles of Meyer (15) and Anitschkow (1).

Anitschkow (1) attempts to classify the arterial supply of dystopic kidneys into four groups: First, those with a solitary artery arising from the aorta. Second, those with additional branches arising from the side of the aorta. Third, those with additional branches arising from branches of the aorta.

Fourth, those with no direct branch from the aorta, the entire supply coming from branches of the aorta. He describes a number of specimens in which one of the renal arteries, or a branch of one, enters the kidney substance directly, not going to the hilum. He also calls attention to the frequency with which the arteries run in grooves upon the surface of the kidney before entering its substance, thus more or less completely "engirdling" the kidney. This is seen in my specimens, Nos. 1 and 4.

Meyer and Anitschkow both call attention to the anomalies of the renal veins. In a general way, the veins empty at points corresponding to the origin of the arteries. In some cases a persistent portion of the embryonal cardinal vein assists in the formation of a renal vein.

The ureter is generally shorter than normal, especially so where the kidney occupies a position wholly or partly within the pelvis. The ureters open into the bladder at the normal site, as a rule, even in crossed dystopia, as seen in my case.

The location of the misplaced kidney varies within wide limits. Frequently it is found entirely within the small pelvis, sometimes behind the uterus, at other times at one side of the uterus. Many more are partly within the small pelvis, resting upon the promontory of the sacrum, the sacro-iliac joint, or the linea innominata. Others are found higher up, in the iliac fossa, at the side of the vertebral column or upon the front of the vertebral column. Of all localities, the rarest is that of the mural kidney, the location being in a pocket of the parietal peritoneum, a case of which is reported by Dorland. The misplaced kidney is usually found upon the side where it normally belongs, but cases of crossed dystopia are not extremely rare. In the latter case there is, in the majority of instances, end-to-end fusion of the kidneys, forming the so-called sigmoid kidney, although in a lesser number of cases the two organs, quite distinct, lie upon one side of the vertebral column, a condition which Dorland (7) in his classification designates "right- or left-sided double kidney (non-fused)."

As my personal case was of the class last named, it is interesting to note here that

Cathelin (quoted by Sträter) found in nineteen cases only five where fusion was absent; Meennacher (quoted by Dorland) found nine cases, and Dorland four cases.

In contradistinction to floating kidney, the congenitally misplaced kidney is more commonly the left. Thus Cadore (quoted by Sträter) in forty-five cases found the right kidney misplaced thirteen times, the left twenty-nine times, both kidneys three times. Nearly all these were discovered at autopsy. Of Sträter's sixty-seven clinical cases, fifty-seven record which kidney was displaced, as follows: Right, 19; left, 34; both, 2; supernumerary, 2.

The misplaced kidney is, with the rarest exceptions, retroperitoneal. Cases have been found where the kidney is partially between the layers of the mesosigmoid, or partially within the broad ligament, Sträter's personal case was entirely intraligamentary.

The adrenals do not accompany the kidney in its dystopic location. Sträter says that they are always found in their normal locations and the recorded cases do not bear out Morris' (16) observation that the adrenals were displaced in nine out of twenty cases.

Defects in the genital organs of both sexes, of the bladder and of the rectum have been noted in cases of misplaced kidney. If the defect of the genitalia or bladder is unilateral, it is found on the same side as the misplaced kidney.

Among others, the following defects have been reported: Unicorn uterus; bicorn uterus; double uterus; uterus and one tube absent, uterus, upper part of vagina and inner portions of tubes absent; uterus and vagina absent, testicle atrophic and located in inguinal canal; one-half of bladder partially undeveloped; one-half of bladder absent; atresia ani.

Cullen (6) reports a case of right pelvic kidney, the left kidney being absent, in which the uterus and vagina were absent and in which both ovaries, with portions of the tubes and round ligaments, were located in the inguinal canals.

Dorland (7) collected from the literature, during the twelve years, 1898 to 1910, one hundred and twenty-one cases of renal anom-

alies, to which he added reports of two personal cases, making one hundred and twenty-three in all. Of these, twenty-one were misplaced kidneys without fusion of the two organs.

*Pathology* In the majority of cases the misplaced kidney is normal in structure, but its abnormal location does not exempt it from the pathological conditions found in kidneys normally located; in fact, its location at times would seem to favor hydronephrosis (which, if infection occurs, becomes pyonephrosis), on account of interference with the flow of urine through the ureter.

In his sixty-seven clinical cases, Sträter found twelve cases of hydronephrosis and six of pyonephrosis. Other pathological conditions found are calculus, sarcoma, tuberculosis and cystic degeneration.

In Brooks' (4) case there was a twin pregnancy at three months, the kidney was compressed and rotated so as to compromise its vascular supply. Death resulted from uræmia. The other kidney, normally situated, showed acute hæmorrhagic nephritis.

*Clinical manifestations.* The symptoms caused by a misplaced kidney otherwise normal are most frequently similar to the symptoms caused by diseases of the uterine adnexæ. While in autopsy findings misplaced kidneys are about equally frequent in the two sexes, the clinical cases are much more frequent in women. Sträter, in his sixty-seven clinical cases, found normal kidneys forty-two times in women and four times in men. This is accounted for partly by the fact that a kidney located in the small pelvis is more prone to cause symptoms in a woman than in a man, and partly by the greater frequency of pelvic examinations and pelvic operations in women, these leading to the discovery of the abnormally placed kidney.

Common symptoms are pain in the lower abdomen, in the back, loins, buttocks, sometimes radiating into the lower limbs; a feeling of weight in the lower abdomen, all of which are subject to aggravation at the menstrual periods. Pain on coitus has also been noted.

The question has arisen as to how far the disturbances of menstruation are due to the misplaced kidney, and how far to coexisting

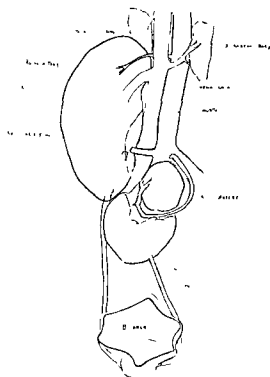


Fig. 1. Anterior view of specimen No. 1 from the museum of Rush Medical College

pathological conditions of the adnexa. Sträter holds that the kidney may, of itself, cause such disturbances and cites his own case in proof.

In some cases the symptoms are due to pressure on the rectum, constipation being the chief complaint. In Chavannez's case, cited by Sträter, a left hydronephrotic kidney, lying between the leaves of the mesocolon, led to a diagnosis before operation of carcinoma of the sigmoid.

At other times bladder symptoms predominate, enuresis and tenesmus being the more frequent manifestations. Symptoms due to pressure on the vena cava have never been pronounced.

Psychic disturbances have been noted in two cases.

The uterus and other pelvic organs may be displaced by a pelvic kidney.

The question as to whether a misplaced kidney can be the cause of abortion is not

settled. There are a considerable number of cases reported where parturition was interfered with, sometimes only to the extent of lengthening the duration of labor, but at other times causing abnormal presentations and in one case rupture of the uterus.

In pathological conditions of the misplaced kidney there are found, in addition to the symptoms already noted, the symptoms ordinarily accompanying the pathological condition with which we may have to deal. In hydronephrosis, the most common pathological condition, the symptoms have been intermittent in several cases, just as in hydronephrosis in a normally placed kidney. Other conditions, as stated above, are pyonephrosis, calculus, sarcoma, tuberculosis and cystic degeneration, each exhibiting the symptoms ordinarily expected in those conditions.

**Diagnosis.** In favorable cases palpation is of great assistance in making the diagnosis. If the kidney is otherwise normal, one can make out the size, shape and consistency, and in some cases even the hilum with its pulsating artery can be identified.

Failure to find a kidney in the normal location is confirmatory of the nature of the tumor under investigation, but, owing to the fact that normal kidneys normally located frequently cannot be palpated, this negative evidence is not of great value. On the other hand, finding both kidneys in the normal location does not exclude the possibility of a dystopic supernumerary kidney, as shown in one of McArthur's cases.

The misplaced kidney is generally so fixed in its retroperitoneal location that it is scarcely at all movable. Certain cases have, however, acquired a considerable mobility, and in some cases the kidneys are not entirely retroperitoneal, but partially intraligamentary, thus having more mobility. An entirely intraligamentary kidney, of which Sträter's case is the only example, would be still more movable.

This fixation, absolute or relative, is one of the distinguishing points between misplaced and movable kidneys, the latter having great mobility, as a rule, although in some cases fixation in an abnormal position is acquired by a movable kidney.

Catheterization of the ureters sometimes shows a considerable difference in the lengths of the two ureters, differences of from ten to fifteen cm. having been noted.

Inserting into the ureters bougies which cast a shadow with the X-ray and then taking a skiagram will give valuable information. The X-ray is also of value by showing the shadow of the kidney and thus indicating its location.

Munro (17) says that the cystoscopic examination has several times revealed a pulsation in the trigone due to an underlying renal artery.

Misplaced kidney is more common on the left side, whereas movable kidney is more common on the right side.

Finding some of the anomalies of the genital apparatus noted above will furnish confirmatory evidence.

If the kidney is exposed by operation, the most decisive finding is the abnormal origin of the vascular supply.

In pathological conditions of the misplaced kidney we find the symptoms and signs common to these same conditions, when found in the normally placed kidney. If the ureter is patulous, the urinary findings will aid in the diagnosis.

**Differential diagnosis.** Misplaced kidney is most often mistaken for a tumor of the adnexæ, especially an ovarian cyst. If a pelvic kidney is pyonephrotic, it may be mistaken for a pus tube. If the symptoms are chiefly referable to bowel disturbance, carcinoma of the bowel may be suspected. If there is an accompanying defect of the vagina, hæmatometra may be diagnosed. Cases have been diagnosed appendicitis, pericystitis, retroperitoneal cyst or tuberculosis of mesenteric glands. In two reported cases the symptoms were preceded by trauma, in one of which ileus was diagnosed, in the other hæmorrhage with peritonitis.

**Treatment.** Sträter, in 1906, collected sixty-seven clinical cases of dystopic kidney, to which I have been able to add seventeen cases, making eighty-four clinical cases in all.

In sixty-three of these cases operations referable to the kidney were performed.

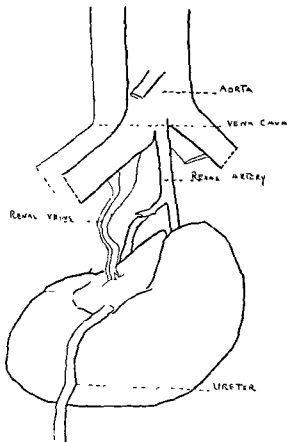


Fig 2. Anterior view of specimen No. 2 From the museum of Rush Medical College

Fifteen of these operations were exploratory as far as the kidney was concerned, nothing being done to the kidney beyond exposing it sufficiently to make sure of the condition. Forty-eight of the operations included some procedure involving the kidney. These procedures were nephrectomy, 34 times; nephrotomy or pyelotomy, 3; shifting the position of the kidney and re-implanting it, 3; removal of calculus, 3; excision of part of the kidney, 2; fixation to abdominal wall, 1; attempted nephrectomy, 1; and puncture after trauma, 1.

The results were as follows: Nephrectomy: recovery, 23; deaths, 7; not stated, 4. Nephrotomy (or pyelotomy): recovery, 1; death, 2. Re-implantation: recovery, 3. Removal of calculus: recovery, 3. Excision of part of kidney: death, 2. Fixation to abdominal

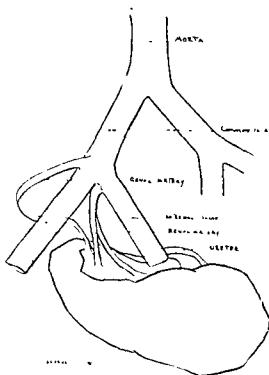


Fig 3 Posterior view of specimen No 3 from the museum of Rush Medical College

wall: not stated, 1. Attempted nephrectomy: death, 1. Puncture after trauma: death, 1.

In three of the nephrectomies the removed kidney was proved at autopsy to have been solitary. In both cases of excision of a part of the kidney the autopsy showed that there was no other kidney.

In order to make these statistics of value, the cases in which the kidney structure was normal should be separated from those in which a pathological condition was present.

We will exclude from the thirty nephrectomies in which the result is stated the three where the kidney was proved to be solitary, making death inevitable. Of the remaining twenty-seven cases, thirteen showed normal kidneys and fourteen pathological, of which latter nine were hydronephrotic and five pyonephrotic.

Of the thirteen cases where nephrectomy was performed, the kidney being normal, ten

recovered and three died. In one of the recovered cases the removed kidney was supernumerary. Excluding this one case of supernumerary kidney, there remain twelve cases of nephrectomy, of which three died, making a mortality of twenty-five per cent. In two of the fatal cases it is not stated whether the second kidney was proven to be present or not. In my own case, which ended fatally, the second kidney was present and was considerably above the average size. The autopsy showed it to be normal in structure.

Of the fourteen cases where nephrectomy was performed, the kidney being in a pathological condition, thirteen recovered and one died. The one fatal case was that of a child of fourteen months with pyonephrosis.

Of the three cases where nephrotomy was performed, two were pyonephrotic, both of which died, one was a patient with intermittent hydronephrosis, who was living more than eighteen months after the operation, but still required a drainage tube.

The three cases where re-implantation was performed all showed normal kidneys and all recovered.

In the three cases where a calculus was removed, there was normal kidney tissue, but in one case the kidney was about one-half normal size, and in one case the kidney was supernumerary. All three recovered.

Of the two cases where excision of part of the kidney was performed, both were solitary kidneys, one of which was of normal structure, and the other had a tubercular lower pole, which latter was removed. Both died.

The case where fixation to the abdominal wall was performed is but briefly reported, and it is not stated whether the kidney was normal, but we may assume that it was. The result of the operation is not stated.

The case of attempted nephrectomy was in a patient where drainage had previously been performed for hydronephrosis. Adhesions rendered the nephrectomy impossible. Death.

The case where puncture was performed after trauma showed a most unusual anatomical arrangement. The kidney had four lobes, each with its own pelvis and ureter. These four ureters emptied into a sac containing one

litre of bloody urine. One ureter led from this sac to the bladder. The sac had been ruptured by the trauma. Death.

In deciding upon the proper treatment of dystopic kidney, it is well to consider separately the cases where the kidney structure is normal, and those where a pathological condition is present.

In all cases, of course, the imperative rule holds good, just as in the case of normally located kidneys, to determine the presence and functional capacity of the second kidney.

In pathological cases, the treatment must be the same as in similar cases in normally placed kidneys, the method of approach in operative cases being modified so as to adapt it to the abnormal location of the kidney.

In cases where the kidney is of normal structure, as a rule, no treatment is needed. If pronounced suffering or disability is caused, operative treatment is indicated. Morris (16) states that nephrectomy is the proper procedure in such cases. The fact that in my case of nephrectomy death resulted from anuria, in spite of the presence of a second normal kidney of more than average size, makes me feel that this operation is too dangerous to be recommended except as a last resort.

Sträter says that sometimes accompanying pathological conditions of the adnexa give rise to the symptoms attributed to the dystopic kidney, in which case the diseased adnexa should receive appropriate treatment and nothing done to the kidney until it is proved that other treatment is unavailing. If it is determined that the dystopia is the real cause of the symptoms, he recommends operative dislocation and fixation in another place. In his personal case, which was unique in presenting the only completely intraligamentary dystopic kidney on record, he was able to push a pelvic kidney up into the iliac fossa and retain it there by suturing, with entire relief of symptoms. He says that, if the symptoms are due to pressure on the bowel, a slight dislocation of the kidney is sufficient to give relief.

Munro (17) says that in a number of cases where the kidney has been transplanted, nephrectomy was required later, on account of the persistence of the symptoms. He adds

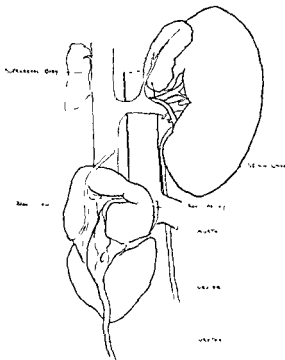


Fig. 4. Anterior view of specimen No. 4. From the museum of Rush Medical College. Bladder arrangement normal. (See posterior view, Fig. 5.)

that a pelvic kidney probably cannot be transplanted, and hence advises removal of such a kidney, even though healthy, if it produces symptoms, because of mechanical interference with intestinal functions.

I would sum up the treatment of cases of dystopic normal kidney as follows:

No operative interference unless the symptoms are of considerable severity.

If adnexa are diseased in such a manner as to make their removal proper, as, for instance, in cases of pus tube or ovarian cyst, remove the offending adnexa, leaving the kidney *in situ*. In many cases all symptoms will disappear; if not, the kidney may be dealt with later.

If operation on the kidney itself is required, the operation of choice is dislocation of the kidney and re-implantation in a location where it will not be a mechanical hindrance.

If the above procedures do not suffice or cannot be successfully carried out, nephrectomy, as a last resort, should be performed.

In all operative procedures on the normal



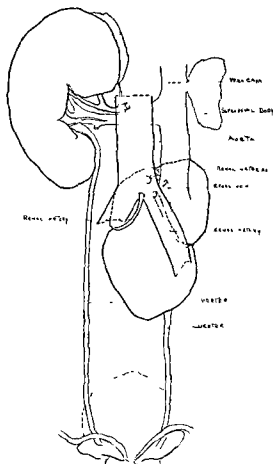


Fig 5 Posterior view of specimen No 4 From the museum of Rush Medical College

kidney, where nephrectomy is not from the first inevitable, great care must be exercised not to damage the kidney structure or vessels in such a way as to make the removal of the organ unavoidable

As to the method of operative approach in case of a normal dystopic kidney, it seems to me that ventral laparotomy is alone to be considered

In pathological dystopic kidney other routes have been used. Of these the sacral route appears to be difficult and unsatisfactory. Bevan (2) in one of his cases used a muscle-splitting incision, such as is employed for removal of the appendix, the peritoneum

was pushed back and the kidney reached retroperitoneally. Cragin (5) reports an unique case of vaginal nephrectomy following tapping of a hydronephrotic kidney. In the majority of these cases, also, a ventral laparotomy will be the procedure of choice.

In pregnancy and parturition a dystopic kidney may present new problems, if located in the small pelvis. The amount of interference with labor will depend upon the degree of narrowing of the diameters of the pelvis. The recorded cases show that delivery, although often prolonged and difficult, can take place in the majority of cases without operative interference.

The dystopic kidney, as a rule, has but slight mobility and consequently cannot be pushed up out of the way during parturition, as can many pelvic tumors.

Strater sums up the management of dystopic kidney in pregnancy and parturition as follows

If discovered at the beginning of pregnancy: laparotomy, dislocation, fixation.

If discovered later, consider the advisability of the induction of premature labor.

Do not think of removing a normal kidney shortly before or during labor

If discovered after labor has begun, a pathological kidney may be punctured to allow delivery, nephrectomy to be done after the puerperium

If, during parturition, delivery cannot take place without injury to mother and child, either, in case of a dead child, perform craniotomy, or, in case of a living child, Cesarean section, or an operation to widen the pelvis

Cragin (5), in the ninth month of the third pregnancy, made a vaginal incision through which he removed a hydronephrotic kidney from his patient, first reducing the size of the kidney by puncture. Fifteen hours later the patient was delivered of a living child. She made a good recovery. I believe that in a similar case Cesarean section would be a safer procedure

Willson (22) says: "Version, as shown by the statistics of the collected cases, would seem to be too dangerous both to child and mother to receive serious consideration."

## PLUMMER: DYSTOPIC KIDNEY

### CASE REPORTS

My personal case was reported informally to the Chicago Surgical Society at its meeting held February 11, 1910, and published in the Transactions of the Society in SURGERY, GYNECOLOGY AND OBSTETRICS, Vol. X, No. 4, p. 431, April, 1910.

**CASE 1** J B, aged 38, male. The patient complained of a swelling located in the region ordinarily occupied by the appendix vermiformis. After having been under treatment on the medical side of the hospital and discharged, he returned and insisted upon an operation to remove the tumor which he said caused him pain and total disability to perform manual labor.

The tumor was easily palpable and its resemblance in shape and consistency to a kidney was remarked. It was practically immovable. The nature of this mass was not determined, but it was thought that it was most probably a displaced right kidney.

On October 13, 1909, an incision was made through the rectus muscle near its outer border and over the tumor, which was found to lie retroperitoneally and to the inner side of the ascending colon. The peritoneum over the tumor was incised and it was then seen that without doubt we had to deal with a kidney, whose lower portion lay on the brim of the pelvis.

An examination was now made as to the presence of other kidneys. Just above the misplaced kidney could be palpated, in the normal position on the right side, a kidney of normal shape, but larger than the average size. This proved later to be a normal kidney of large size. On the left side I thought I palpated a third kidney in normal position, but smaller than the average size. This proved later to have been an erroneous observation, as there was no third kidney.

Thinking, then, that I had to do with a supernumerary kidney, which caused pain and disability, and that the patient was amply provided with renal tissue without the kidney in question I proceeded to remove it. The hilum was turned outward, that is, toward the right side, and the vein and artery could be seen crossing the anterior surface of the kidney in a deep groove. The ureter passed directly downward from the hilum to the bladder. The vessels were ligated and the kidney removed. The posterior peritoneum was closed, and the incision in the abdominal wall closed without drainage.

Twelve hours after the operation, as the patient had passed no urine, a catheter was passed, but no urine found. Twenty-nine hours after the operation one dram of urine was withdrawn by catheter. No more urine was passed until six full days after the operation, when three ounces were voided. The following day he voided urine three times, amounting to five ounces in all. On each of the two following days he passed a small amount of urine, which was not measured. He died ten days after the

operation, having passed not more than ten or twelve ounces of urine during that period.

During this time and up to within twenty-four hours of his death his general condition was remarkably good for a man who was passing practically no urine. Although at times emesis was frequent, he had periods when he retained considerable amounts of fluid by mouth. He also retained large quantities of normal salt solution per rectum. Sweet spirits of nitre, caffeine, and potassium citrate were administered. The bowels moved well.

Three days after the operation a slight bloody discharge was noticed on the dressings, one stitch was removed and a small gauze drain inserted into the subcutaneous space. The discharge was tested for urea, but none found.

Five days after the operation a small portion of omentum protruded through the wound. The dressings had a urinous odor, and were found to contain considerable urea.

Seven days after the operation a considerable amount of urea was again found in the discharge, as well as a large quantity of albumin.

Nine days after the operation a loop of intestine protruded, upon replacing this eight or ten ounces of fluid escaped, which was clear and sticky and had the odor of urine. The intestinal loop was retained by a gauze pad, covered with a strip of adhesive plaster.

The patient died ten days after the operation.

**CASE 2** Dr J B. Murphy, personal communication. Patient was operated originally at forty-two years of age, in October, 1899. He had a history and symptoms of stone in the right kidney. The usual incision in the loin was made and the kidney could not be reached. It was found dislocated downward and firmly fixed near the pelvic margin. An anterior incision was then made through the right rectus muscle, the kidney exposed, the anterior peritoneum sutured to the margin of the pelvis, the pelvis opened and two stones extracted. The ureter was patent. The kidney was aplastic and only about one-half the normal size. Its vessels were not over half an inch in length and were attached to the aorta and vena cava just at the iliac bifurcation. A drain was maintained through the anterior abdominal incision for ten days, at which time it was removed, the urine ceased to discharge and the patient recovered.

He returned to the hospital on September 6, 1903, with symptoms of recurrence of stone in the kidney, and was then operated by me a second time. We then opened the abdominal wall by a longitudinal incision, seven inches long, one inch to the right of the median line. The posterior peritoneum was divided and the kidney lifted up. The great mesentery was displaced to the left, the kidney was situated just above the promontory of the sacrum, close to the midline, with vessels not over one-half to three-fourths of an inch in length. The pelvis was dilated. Tipping the kidney with its pelvis backward and convex surface forward, the kidney was rotated on its axis, rotating it also to the left until

the dilated pelvis was exposed. The anterior peritoneum was then freed and sutured around the margin of the pelvis. The kidney itself was about two-thirds its normal size. The pelvis was dilated to four times the normal size. Fixing the peritoneum firmly to the wall of the pelvis with continuous sutures, the pelvis was opened and a large number of stones could be palpated. The kidney appeared to be considerably larger than it was at the primary operation.

On March 2, 1904, he came in a third time with similar symptoms. The kidney was again exposed. As it could not be moved now, being fixed to the anterior abdominal wall, a packing was placed around the pelvis. This packing was retained for ten days, at which time the kidney was opened and two small stones removed.

He was in the hospital again in November, 1911, but had no symptoms of return of his kidney trouble, and was perfectly well as far as the kidney was concerned.

CASE 3. Dr W. H. Allport, personal communication. W. C. N., male, aged 38 years. Had always been reasonably healthy until one year ago, when he noticed a pain in the left side of his abdomen, low down. At about the same time he noticed a lump in this locality. He had had no symptoms referable to the urinary organs or the bowels. On palpation a smooth, firm mass can be made out to the left of the spinal column, its upper end at the level of the last lumbar vertebra, its lower end dipping down into the small pelvis. This mass is convex on its left border. No depression corresponding to a hilum can be palpated. The mass is slightly movable.

On March 1, 1911, an exploratory laparotomy was performed through a median incision. The mass was recognized as a dystopic kidney. Palpation of the region of the right kidney, with the hand in the abdomen, failed to reveal the presence of a right kidney, so nothing was done to the left dystopic kidney. After removal of the appendix the incision was closed.

CASE 4. Dr A. D. Bevan, personal communication. Operation was performed for supposed stone in the left kidney, the skiagram showing a shadow in this location. No kidney was found, but a mesenteric gland containing a calcareous deposit was discovered, this accounting for the X-ray shadow.

At autopsy a short ureter was found leading to a pouch about the size of an almond and containing pus. This was undoubtedly a rudimentary pyonephrotic dystopic kidney.

CASE 5. Dr A. D. Bevan (2). Patient, an adult male. Four or five years before he had had an exploratory laparotomy. Palpation reveals a tumor a little to the right of the median line, just below the umbilicus, tender to pressure. Patient suffers from severe attacks of pain which last hours or days. Urine contains pus and blood. An X-ray examination disclosed a stone in front of the promontory of the sacrum. The ureters were catheter-

ized; the catheter that went into the right ureter made a short curve about three inches long, while the one in the left ureter went into the entire length of the normal kidney pelvis. The X-ray is a beautiful example of work of this kind. An X-ray was taken with the catheter *in situ*. It proved definitely the presence of stone in the misplaced right kidney. The question was how to remove it, whether a midline incision should be made, and whether the transperitoneal or retroperitoneal route should be adopted. The retroperitoneal route was decided upon and it was simplicity itself. A muscle-splitting incision, such as we use for an appendix operation, was made, and then enlarged by stretching and with no difficulty at all one could reach, after stripping back the peritoneum and not going into the peritoneal cavity, the pelvis of the kidney. Pyelotomy was made and the stone removed from the pelvis and ureter. Drainage was simple. A cigarette drain was inserted down to the point, no attempt was made to close the opening in the pelvis, because of the considerable depth of the wound and the difficulty of such a procedure. The patient went on to an uninterrupted recovery. The kidney was not removed because it seemed to contain a great deal of normal kidney tissue.

CASE 6. Dr L. L. McArthur (14). A man, of middle age, laborer, comes to the hospital with a classical history of right renal colic, hematuria, purulent urine, no fever. He has passed gravel recently, causing the hematuria for which he enters the hospital. The X-ray shows shadow in the renal region, and in the ureter above the iliac crest a shadow. Segregation shows a normal left ureter. On operation the calculus was readily found and removed from the kidney. Sounding the ureter from above, in search of second stone, revealed no second stone, but on tracing down the ureter about two inches there was found a branch joining it which would have led one to doubt his anatomy had it not been possible to confirm its identity by the ureteral sound. Tracing this lateral branch one soon came upon a small tumor which, on being brought into the wound, proved to be an accessory rudimentary kidney. In its pelvis could be felt a small calculus. This was removed by incision through the pelvis with immediate suture. Recovery uninterrupted.

CASE 7. Dr L. L. McArthur (14). Babe of fourteen months, suffering for six days with symptoms that seemed to approximate a partial intestinal obstruction or intussusception. The child had fever, vomiting, great difficulty in securing bowel movement, urine very scanty on diapers. Because of the tumor to be felt in the abdomen I was invited to see the case in consultation. This tumor was in the lower abdomen, in the mesial line immediately behind the symphysis, was spheroidal, elastic, tense but fluctuating, and, on bimanual examination, no other conclusion could be drawn but that it was an overdistended bladder, so exactly did it answer all requirements but that of catheterization. Catheterization showed less than a dram of purulent, al-

buminous urine. I therefore made a tentative diagnosis of suppurating urachus cyst with poor drainage into bladder, and advised operation.

On opening the abdomen, the fluctuating tumor at first glance appeared to be a distended uterus, but close examination proved it to be a cystic kidney congenitally malposed, with a widely dilated ureter of about two inches in length, emptying through a constricted ureteral orifice into the bladder, its vascular supply from the neighboring left iliac vessels. Its walls appearing thin and its contents purulent, a quick nephrectomy was done, with fatal issue within twenty-four hours. No post-mortem obtainable. A kidney was to be palpated in the right loin, some urine was excreted during the remaining hours of life.

CASE 8. Dr. L. E. Schmidt and Dr. H. L. Kretschmer (21). Mrs. S., a very stout woman, giving a history of abdominal pain around the umbilicus, associated with occasional attacks of nausea and vomiting. At times pain could be elicited upon deep pressure over the umbilicus. An indefinite rounded mass, of solid consistency, could be palpated in the median line. In order to exclude a lesion of the kidney, double-sided ureteral catheterization, with fuse-wire catheters, combined with X-ray, was undertaken. On the right side of the catheter can be seen, passing up to the normal position of the kidney, the end of the catheter passing to the upper border of the last rib. On the left side the catheter stops at a point corresponding to the lower border of the third lumbar vertebra. The straight course of the shadowgraph catheter up to its end leads us to believe that we are dealing with a congenital dystopic kidney.

CASE 9. Dr. Aug. Lindemann (13). Man, aged 23 years. Healthy until four days before entering hospital. Vomited several times. Pain in lower abdomen. No fever. Tumor palpable above symphysis; also per rectum. Fluctuating. Numerous leucocytes in urine. White blood count, first day 5,000; second day 10,000. Tumor only slightly movable.

Laparotomy. Median incision. Tumor found to be retroperitoneal. The posterior peritoneum was cut and a cystic tumor lying on the promontory of the sacrum exposed, which was taken to be a kidney. Exploration of the normal kidney regions showed the presence of a normal left kidney and absence of the right kidney. As there was but little normal tissue in the tumor, it was extirpated. The sac contained a large amount of turbid fluid of urinous odor. Drainage. Recovery. Discharged from hospital five and one-half weeks after operation.

CASE 10. Drs. Munro and Goddard (18). Man, aged 23 years. Had had attacks of general abdominal pain, with vomiting and fever. At such times a tumor was palpable in the left lower quadrant of the abdomen. The attacks would last three or four days and disappear when the bowels moved.

Four months before he had headache, fever, malaise, constipation, with dull bearing-down pain

in bladder, and was operated upon in a neighboring city, at which time the tumor in the pelvis was drained of a puriform fluid. A sinus remained, discharging a substance resembling vaseline.

Dr. Munro enucleated the tumor. The left kidney was palpated and found normal. Later a skiagram showed the right kidney in normal location. This, then, was a case of pyelonephrosis of a supernumerary kidney. The patient recovered and six months later was in good health.

CASE 11. Dr. John C. Munro (17). Man, aged 48 years. Complained of constipation, constant backache and colicky attacks.

Laparotomy. The left kidney was in its normal location and normal in structure. No kidney was found in the right loin. The right kidney was located on the promontory of the sacrum a little to the right of the median line, the lower pole being deep in the pelvis. The kidney was somewhat lobulated. Nephrectomy was performed. The patient recovered and four months later was free from colic and had less backache.

CASE 12. Dr. A. B. Johnson (11). Boy, aged 12 years. The left kidney was located in front of the left sacro-iliac joint. Its pelvis contained two ounces of pus. The arteries originated from the internal iliac and the veins emptied into the internal iliac. Nephrectomy. Recovery.

CASE 13. Dr. A. B. Johnson (12). Man, twenty years. Intermittent hydronephrosis. Kidney exposed by lumbar route, a quart of bloody urine evacuated. Drainage. After the operation ureters catheterized with stylet catheters and a skiagram taken with the catheters *in situ*, which showed that the catheter in the right ureter crossed the median line of the body to the left side in the mid-lumbar region, so that the upper ends of both catheters lay to the left of the median line.

At a second operation, eighteen months later, it was found that the right kidney was a rounded mass, two inches in diameter, fused with the lower pole of the left hydronephrotic kidney. The peritoneal cavity was opened and the absence of a kidney on the right side demonstrated. Soon afterward the patient had an anuria of forty-eight hours' duration, and suffered great pain. A small incision was made and the kidney again drained. No stone found. A catheter was left in the wound and clamped.

CASE 14. Dr. James W. Henson (9). Man, aged 22 years. There was a history of four or five attacks, each having the following characteristics: More or less rapid onset, acute throbbing pain in the upper part of the left side of the hypogastric region, lasting from three to ten days; pronounced tenderness in the same region, which did not subside for several days after the acute pain was relieved; nausea, which was more pronounced in the first attack and less so in the last; apparently little elevation of temperature and apparently no abnormality in the quantity or quality of urine.

An enlargement or mass was not noticed in the

first attack, but in all the others its presence was early manifested, though it apparently disappeared several days after the subsidence of the more acute symptoms. The first attack, in the autumn of 1905, was just after a hearty supper. The patient says that at no subsequent time did there appear to be any relation between diet, drinks or condition of bowels and the attacks. Operation was done by the writer May 27, 1909. The mass proved to be a congenitally misplaced kidney lying in the true pelvis, chiefly to the left of the median line. Since we now describe the sigmoid flexure of the colon as reaching to the middle of the sacrum, the kidney lay behind the lower end of this portion of the gut and the upper end of the rectum. To reach the organ the right layer of the sigmoid mesocolon was opened. The ureter was necessarily very short. The pelvis of the kidney was distended to the capacity of three or four ounces, but there was left a good deal of functionary kidney tissue. Periodic obstruction of the ureter, of course, explained the symptoms. Nephrectomy was done. As it was necessary to drag the kidney upward to get a ligature around the vessels, and as the pedicle was very short, the presumption is that the blood supply came from the internal iliac artery.

CASE 15 Dr. S. C. Gordon (8). Man. Tumor located at brim of pelvis—removed—proved to be kidney. Anuria, death. It is not stated whether the presence of the other kidney was proven.

CASE 16 Dr. S. C. Gordon (8). Woman. A large and troublesome kidney was removed. The patient lived twenty-seven days, "although not a drop of urine had been secreted." The autopsy showed the absence of the other kidney.

CASE 17 Dr. Thomas S. Cullen (6). O. C. J., female, aged 17 years, white. Laparotomy. The right kidney was about half as large again as a normal kidney and completely filled the right half of the pelvis. The bladder and rectum were the only other organs in the pelvis. The left kidney was absent. No vagina or uterus was present. Both the ovaries were in the inguinal canals. Nothing was done to the kidney. Recovery.

#### SPECIMEN NO. 1 PLUMMER'S CASE (Fig. 1.)

The left kidney is dystopic; it lies upon the right sacro-iliac joint, the lower two-thirds being in the small pelvis, its upper pole resting against the lower pole of the right kidney. It is of normal size and structure, but somewhat misshapen. The posterior surface shows a broad groove marking the position where it rested on the sacro-iliac joint. The hilum is directed toward the right. Upon its anterior surface is a deep, narrow groove, passing obliquely from above downward and toward the right, and containing the renal artery and vein. The renal artery arises at the bifurca-

tion of the aorta, being directed at first downward and to the left, then circling toward the right and crossing the entire anterior surface of the kidney to enter the hilum. The ureter passes downward and to the left behind the kidney, opening into the bladder in the normal location on the left side. Its length is about 13 cm. This, then, is an example of crossed dystopia without fusion. The suprarenal body is in its normal position. The distance from its lower end to the upper end of the kidney is about 7.5 cm.

The right kidney is of normal shape and normally located. It is larger than an average kidney in all its dimensions; so that its total bulk is almost twice as great as usual. Its structure is normal. Its arterial supply is anomalous. One small vessel arises from the level of the celiac axis, and passes into its anterior surface, near its upper end. A much larger vessel arises from just above the bifurcation of the aorta and passes to the hilum at a level of the junction of the lower and middle thirds of the kidney. One large vein emerges from the hilum and crosses the anterior surface from below upward and inward, emptying into the vena cava. The ureter passes downward, its first 4 cm. being imbedded in kidney tissue lying near the anterior surface of the organ. It passes into the bladder in the normal location. Its length is about 18 cm. The suprarenal body is in its normal location at the upper end of the kidney.

#### SPECIMEN NO. 2. (Fig. 2.)

Anomaly discovered post-mortem. Right kidney dystopic. Its exact position in the body is not recorded, but it probably lies partially within the small pelvis. It is a little smaller than an average kidney. The hilum is directed almost upward, but slightly to the right. The artery arises from the bifurcation of the aorta, and divides before reaching the kidney, one branch entering the upper pole of the kidney, the other the hilum, the latter branch being accompanied by the vein toward its termination. The ureter passes across the anterior surface of the kidney and opens into the bladder in the normal position. The suprarenal body is not present in the specimen.

The left kidney is not present in the specimen, but was presumably normal. The terminal portion of its ureter is present and normal. (Bladder present in specimen, but not shown in drawing.)

#### SPECIMEN NO. 3. (Fig. 3.)

(In the drawing the specimen is shown as viewed from behind.)

Anomaly discovered post-mortem. The left kidney is dystopic. It is located entirely in the small pelvis. It is something more than one-third the size of an average normal kidney. Its hilum is directed upward. One artery arises from the internal iliac just at the bifurcation of the common iliac; it bifurcates before reaching the hilum. Another artery arises from the outer side of the common iliac just at the origin of the external iliac. Vein and suprarenal body not shown; only short portion of ureter shown. The right kidney is not present in the specimen, but was presumably normal in size and location.

#### SPECIMEN NO. 4 (Figs. 4 and 5)

Anomaly discovered post-mortem. Cause of death, chronic parenchymatous nephritis (large white kidneys).

Right kidney dystopic. The kidney has nearly twice the bulk of an average kidney, its large size being partly due to its pathological condition. Its length is but a little greater than its breadth, the shape thus approaching the quadrangular. Its thickness is a little less than that of a normal kidney. The posterior surface shows a shallow depression near its lower third, from which I would judge that the kidney rested on the promontory of the sacrum, its lower third being in the small pelvis. On the anterior surface are two deep transverse furrows, the lower one crossing the entire surface, and the upper one being confined to the middle third. The artery arises from the right common iliac just at its origin from the aorta; it passes outward, across the posterior surface of the kidney, and around its outer border, running in a furrow all the way, entering the kidney in the lower transverse furrow in front. There are two veins, one emptying into the vena cava and accompanying the artery; the other passing up

over the front of the kidney, where it anastomoses with the first vein, and empties into the vena cava in front. The pelvis of the kidney is large and extends vertically from one furrow on the anterior surface to the other, dipping down into each. The bladder is not present, but apparently the ureter is about 10 cm. shorter than that of the left kidney.

Suprarenal body in normal position; the distance from its lower end to the upper end of the kidney is about 4 cm.

The left kidney is normal in shape, location and vascularization, but pathologically enlarged; left suprarenal at its upper pole.

In closing, I wish to express my thanks to Dr. E. R. Le Count for the use of the specimens from the Museum of the Rush Medical College, and to Drs. J. B. Murphy, W. H. Allport and A. D. Bevan for reports of unpublished cases.

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## A NEW TYPE OF ECTOPIC GESTATION—PREGNANCY IN AN ADENOMYOMA UTERI

By THEODORE O. DOEDERLEIN, M. D., AND MAXIMILIAN HERZOG, M. D., CHICAGO

THE fertilized human ovum in normal placentation is implanted into the uterine mucosa. When an ovum develops anywhere else except in the uterine cavity we speak of an ectopic gestation. Even if this occurs, the fertilized ovum, almost without exception, is implanted into a mucosa, namely, that of the Fallopian tube. In fact, it was formerly held that a fertilized ovum could only become implanted in a mucosa originally derived from the Müllerian ducts. We know to-day however, that this is not true, because a few cases of undoubted primary abdominal and primary ovarian pregnancies have been reported. In cases of these types the ovum must have been implanted either in a serous surface, in a ruptured Graafian vesicle, or in a recess of the germinal epithelium lining the ovary. Undoubtedly, a fertilized ovum has very slim chances ever to implant itself anywhere else except into a mucosa, hence the only common form of ectopic gestation is tubal pregnancy, while all others are exceedingly rare. In abnormal uterine gestations, such as pregnancy in a rudimentary horn, interstitial pregnancy, pregnancy in a duplex uterus, etc., the implantation always takes place into mucosa.

The three recognized forms of ectopic gestation are therefore (1) primary tubal pregnancy, which may, in consequence of abortion or rupture, lead secondarily to abdominal or intraligamentous gestation, (2) primary abdominal, and (3) primary ovarian gestation.

We want to add to this list a hitherto unknown fourth form of ectopic gestation, namely, one in a tumor.

We would *a priori* expect that such an event, if it occurred at all, could only take place in a tumor containing epithelial glandular structures, and indeed, the ectopic gestation to be here reported occurred in an adenomyoma of the uterus.

An adenomyoma is a distinct variety of the common leiomyoma or fibromyoma of the uterus. Tumors of this variety are not exclusively composed of unstriated muscle fibres and ordinary connective tissue, but they contain in addition epithelial glandular structures as an integral part of the neoplastic process. These mixed tumors, first minutely and extensively described by von Recklinghausen, are known as adenomyomata. They have been the subject of a good deal of discussion and controversy and it is now conceded that their histogenesis is not a uniform one but that they may owe their origin to a variety of histologic conditions or causes. Von Recklinghausen himself was first of the opinion that the uterine adenomyomata always take their origin from remnants of the Wolffian body or of the Wolffian duct; that is, from embryonic inclusions containing both epithelial and non-striated muscle cells of an early, undeveloped type.

The adenomyomata of von Recklinghausen are preferably found in the posterior wall of the corpus uteri, rarely in the cervix, but also in the tubal wall, particularly near the tubal angle. They are generally intramural, they

may be near the serosa and rarely they are submucous. They are frequently infiltrating in their growth and not sharply defined from the tissue in which they are situated. In the early cases described by von Recklinghausen, the epithelial portion of these neoplasms in type and arrangement was very much like the excretory glomerular and tubular structures of the Wolffian body. The first tumors contained closed tubular spaces, composed of a main canal or ampulla, into which emptied numerous smaller canaliculi arranged in parallel rows like the teeth of a comb. The small canaliculi described possessed a free club-shaped or cyst-like extremity which led into tortuous secretory tubules supplied with cubical epithelium. The tortuous tubules emptied into larger canals lined with columnar, partly ciliated, epithelium, and the larger collecting tubules finally emptied into the main canal or ampulla. The walls of the glandular spaces here and there showed vascular polypoid projections, so-called pseudo-glomeruli. The gland spaces were surrounded by a tissue rich in cells of a young, embryonic type. After a number of adenomyomata of the uterus had been encountered and reported by other observers, it was found that the glandular epithelial portions did not always conform to the description first given by von Recklinghausen and that some of these neoplasms evidently took their origin from invaginations or displaced remnants of Müller's duct, others again from glands derived from the uterine mucosa. Such glands may either congenitally project abnormally deep into the muscularis or they may penetrate deeply into it in consequence of inflammatory stimuli (glandular hypertrophies). R. Meyer who discusses the subject of adenomyoma of the uterus in Veit's Manual of Gynecology, after a review of the literature, gives five different histologic and histogenetic sources of the glandular portions of the various adenomyomata of the uterus which have been reported, viz., (1) The glandular elements may be derived from the uterine or tubal mucosa, they may be found in the tumor in consequence of a congenital anomaly or displacement, or they may have been carried to the matrix from which the tumor developed

by an inflammatory glandular hypertrophy. (2) The epithelial structures may be derived from the epithelia (endothelia) of the serosa lining the tumor. (3) The adenomatous structures may owe their origin to invaginations or misplaced remnants of the Müllerian duct, (4) or to embryonic inclusions from the Wolffian duct, or finally (5) to embryonic inclusions or remnants of the Wolffian body (urniere). This classification of uterine adenomyomata according to their histology and histogenesis is largely of academic interest only, because it is generally very difficult and often impossible to form an exact opinion as to the structure from which the epithelial glandular portions of the tumor originate.

The history of the case in which an ectopic gestation occurred in an adenomyoma is as follows:

Mrs. K., age 37, had four children, the oldest being fifteen years, the youngest eight years of age. Her labors were easy.

One year ago she had a miscarriage, having been pregnant two months. She had no curettement and bled for one week only. After this miscarriage patient never felt well, she had pain in left inguinal region and in back and felt weak generally. A midwife told her at that time she had a tumor. She was, however, regular for seven months and able to attend to her household duties. In the eighth month patient had a most profuse menstruation, in fact, a menorrhagia. Thereafter patient became pregnant, and her menstruation stayed away for three months. In the fourth month, the end of February, the menses reappeared with labor pains. She then had bearing-down pains and hemorrhages almost continuously until the beginning of May. A midwife had been in attendance for some time. I could not ascertain the line of treatment she pursued. In the beginning of May she called in a physician to make a curettement. Dr. Biernager, noticing the unusual state of affairs, invited me to examine patient at this juncture.

On external palpation I found a tumor-mass, of irregular outline, reaching up to the umbilicus. The consistency was firmer than that of a pregnant uterus. Examining patient vaginally I could feel the uterus, of about three times its normal size, crowded to the right side by a large tumor. The tumor was fairly firm and could be distinctly outlined. The mouth of the womb was open so I could introduce my finger into the uterine cavity and found it empty, at least as far as I could reach up and around the tumor. I now passed a sound with a view to more distinctly explore the fundus and was amazed at the enormous depth the sound passed before it reached rock-bottom, passing far beyond



the fundus. Bearing in mind the possibility of an extrauterine pregnancy, although the consistency of the tumor and the history of the case were against it, I did not dare to make further examination in order to arrive at a positive diagnosis, and advised immediate operation, which, as I fully appreciated, was not devoid of danger owing to the infection of retained placenta as indicated by fever and foul-smelling lochia. The patient was transferred to the German Hospital the following day and operated two days after I first saw her.

On opening the abdomen by the Pfannenstiel method, a mass presented in the incision the size of about a four or five months pregnant uterus, everywhere covered with large, tortuous veins. Upon delivery from the abdomen the mass proved to be a tumor of fairly hard consistency, situated in the left parametrium, crowding the left tube upward. The uterus could be seen as a smaller, softer part of the mass to the right. I decided to do a subtotal extirpation for reasons of the patient's marital relations. Special care had to be taken to avoid hemorrhage and especially to avoid infection from cervical canal. I made perfect peritonization of internal wound, a small drain being left through cervical stump. Although patient had run a temperature of 100 and 101 before operation all I noticed was a slight peritoneal irritation after operation. Otherwise nothing of note occurred during convalescence.

The tumor mass unfortunately was not weighed directly after operation but was of the size of about a four-and-a-half to five months pregnant uterus. The uterus, in intimate connection with the tumor, being about one quarter that size.

On opening the uterus through cervix the cavity was found empty. Above the internal os an oval orifice admitting the tips of two fingers presented itself. Slitting the foramen downward toward the cervix a large cavity within the tumor was brought to view. Attached to the walls of the cavity and almost filling the same was a placenta in good state of preservation, with a few pus foci here and there.

**Pathologic examination.** The specimen removed was examined after it had been fixed and hardened for some time in a four per cent watery formalin solution. If placed in a position similar to that which the mass occupied *in situ* in the abdomen before operation, its general outlines from right to left are those of an egg-shaped body, the larger pole to the left, while the smaller pole points to the right. The greatest circumference from right to left of the whole mass, which has however shrunk considerably in the preserving fluid, is a little less than eighteen inches, and the greatest transverse diameter is a little over seven inches. The mass as a whole is divided

externally into a larger left portion and a smaller right one. The division is brought about by a deep gutter-like constriction, which runs around the whole mass from above downward at right angles to the greatest transverse diameter, not exactly in its center but to the right of it. The circumference of the mass in the gutter-like constriction is eleven to twelve inches.

To the left of the constriction is the tumor proper and to the right the enlarged uterus. The tumor forms about two-thirds of the mass removed, the enlarged uterus about one-third. The greatest circumference of the tumor is from above downward (i. e., in a plane with the cephalocaudal diameter) and is about fourteen inches, the greatest diameter of the mass is here a little less than five and one half inches, and four inches from side to side.

The uterus, which is considerably enlarged, has been severed in the cervix and there is seen at the cut surface an opening, the entrance to the cervical canal. The dimensions of the uterus adherent to the larger tumor mass are as follows: circumference from above downward, twelve inches; greatest diameter from above downward, four and one-half inches; diameter from side to side, three and one-half inches. The anterior portion of the constriction shows remnants of the broad ligament and above is seen the left Fallopian tube with its closed fimbriated extremity attached to the left ovary. This is of rather large size, flattened and shows on section a large corpus luteum, or rather corpus albicans, because the tissues here look grayish white and fibrous and do not show any distinctly yellow color. On the right lateral surface of the uterus are found shreds of tissue, the remnants of the ligaments of the right Fallopian tube and ovary, which had been removed and not preserved with the remainder of the specimen.

After the mass has been laid open in its median plane, parallel with its greatest diameter, it is found that the constriction divides it into a left smaller solid, and a right larger excavated portion, the latter, however, not being empty, but completely filled with a solid mass, which prevents the appearance of a placenta left for some time in the uterine

cavity without, however, having undergone putrefactive changes. This central tissue presents the usual picture of a mixture of coagulated, degenerating blood and degenerating villi. Shreds of amniotic and chorionic membranes can still be distinctly seen. The placental mass fills the greater portion of the tumor on one side of the constriction, and measures four by three inches on the cut surface. It is still fairly well attached to the tumor wall proper. However, the layers to which it is adherent have somewhat shrunk away from the outermost tumor tissue, and there is a distinct peripheral spherical cleft which separates the placenta and the immediately attached tissues from the outer wall of the tumor.

The smaller left (uterine) half of the removed mass is solid with the exception of a small cleft-like cavity, which is continuous with what appears to be the cervical canal. There is no large open communication between the placental cavity of the tumor and the uterine cavity; however, there is a slit or canal-like narrow irregular communication which appears to connect the placental cavity with the uterine cavity. This communicating slit is in a position somewhat below what must at one time have been the left tubal angle.

The weight of the whole mass removed, after having been preserved in formalin, is two pounds, five and one half ounces.

The specimen even macroscopically showed clearly that it could not be a case of interstitial pregnancy nor pregnancy in a rudimentary horn because the entrance of both tubes into the fundus of the uterus could be clearly recognized. Both tubes were also intact and a tubal pregnancy with rupture between the folds of the ligamenta lata could be absolutely excluded.

*Microscopic examination* Pieces for microscopic examination were taken in several places through the whole thickness of the wall of the tumor including the innermost placental and the outermost subserous portions. Such pieces taken through the entire wall were cut into three segments and these were separately embedded and sectioned. Other pieces were taken from the wall of the

uterus proper, next to the uterine cavity, from the upper portion of the cervix, from the canal connecting the tumor and the uterine cavities, from the portion of the uterine wall where Gärtner's duct might possibly be found to lead into the canal connecting the uterine and tumor cavities; also from the tube and ovary.

The irregular tissue forming the internal layer next to the cavity is found to be composed of much degenerated blood with fibrin and hæmatoidin granules and crystals. Here are also found fairly numerous villi, some much degenerated, others in a very fair state of preservation. In some villi the Langhans layer is still present; it is absent, however, in the majority of the well preserved villi. It would, therefore, appear that the gestation had gone on to about the middle of pregnancy, when Langhans layer generally disappears. The tissue next to the degenerated blood and the villi markedly resembles a decidua compacta. However, the decidual cells are not very typical, though characteristic enough to be recognized as such. This tissue resembling a decidua compacta is considerably infiltrated with syncytial masses, some of them having penetrated into the tumor wall for a considerable distance. Both the degenerating blood and the tissue to which the villi are attached show considerable leucocytic infiltration. While this marked infiltration clearly points to an inflammatory reaction, bacteria could not be found in these inflammatory foci and they might simply have been due to the presence and absorption of much necrotic material. There is no regular decidua spongiosa next to the compacta but there are present gland spaces. These are either quite irregular and large, or they are smaller, and then short pouchy tubular spaces appear arranged around an irregular or oval ampullar space. The gland spaces are lined by rather low cuboidal epithelia. In some places the epithelia are higher and more cylindrical. Distinct cilia could not be demonstrated. Here and there the gland spaces show a few hyaline or colloid spherical masses as they are so frequently and abundantly seen in the decidua spongiosa in normal placentation. The epithelial glands are immediately surrounded by a very cellular

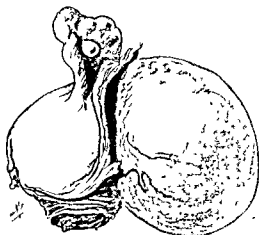


Fig 1 The drawing shows the mass removed, the larger half is the tumor, the smaller one the uterus, the left tube and ovary are elevated towards the apex. The right side of the drawing represents what was situated to the left of the uterus in situ in the abdomen

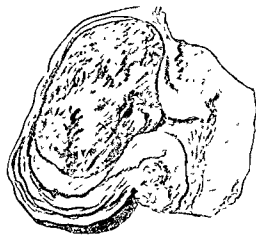


Fig 2 The mass cut open. Here the left side of the drawing shows the tumor cavity with remnants of the placenta attached, towards the right the uterine cavity, cervical canal and canal connecting the uterine and the placental tumor cavity

connective tissue. The cells are quite embryonal in type and here and there approach decidual cells. The muscular tissue is composed of hypertrophied cells and fibers, very irregularly arranged in bundles, and an oedematous condition of the muscularis is generally well marked. Here and there an inflammatory infiltration is seen between the bundles. No gland spaces are found in the outermost subserous portion of the tumor wall.

The uterine mucosa shows a moderate degree of hypertrophy, the gland spaces are complicated, divided by septae, on the whole, rather similar to a decidua spongiosa in a normal uterine pregnancy. The interglandular connective tissue shows rather large cells approaching somewhat the type of decidual cells. The muscularis of the uterus is composed of hypertrophied cells. The degree of hypertrophy of the muscle cells of the uterine wall and those of the tumor wall is about equal. An inflammatory infiltration is likewise seen here and there between the bundles of the muscularis of the uterus. The cervical canal shows no mucosa but an irregular ragged

surface. No mucosa is found in the canal connecting the placental cavity of the tumor and the uterine cavity. Pieces taken from portions where Gaertner's duct might possibly lead into the tumor wall do not show any such structure. Microscopic examination of the Fallopian tube of the left side shows a mucosa of a fairly normal type; however, some of the connective tissue cells of the folds are markedly enlarged and somewhat of the character of decidual cells. Some inflammatory infiltration is found both in the mucosa and muscularis of the tube. However, the mucosa and muscularis are everywhere intact and the microscopic condition excludes the possibility that a rupture of the tube with expulsion of a developing ovum into the folds of the broad ligament could have occurred.

Ovarian tissues taken from the site of the corpus albicans show condensation of the ovarian stroma, almost complete absence of follicles, a few small cysts and a large corpus albicans of the usual structure.

*Epicrisis.* From the macroscopic and microscopic examination of the specimen, it

Fig 3 Placental villi, some penetrating into the decidual tissue

Fig 4 Decidua compacta infiltrated by syncytial masses

Figs 5-7 Epithelial gland spaces in the tumor walls

Fig 8 Hypertrophic, decidua like mucosa of the corpus uteri

Figs 9-11 Microphotographs, all taken at a magnification of 60 diameters



3



4



5



6



7



8

(See legends on opposite page)

appears that there was present an adenomyoma in the left tubal angle or below it. This tumor, of course, contained glandular spaces, which were probably derived, not from any embryonic inclusions originating from the Wolffian body, but from the uterine mucosa. The gland spaces may have been present in the tumor from the very beginning or they may have entered into its substance at a somewhat later period in consequence of inflammatory processes.

Evidently there was a connection between the uterine mucosa and the gland spaces of the tumor. A fertilized ovum, by some un-

explainable coincidence, got into the gland spaces of the tumor and there developed. A fairly typical, though quite irregular, decidua was formed, and the growing ovum stimulated the tumor to rapid growth and created for itself a cavity to accommodate the placenta. Pregnancy was interrupted, the embryo died and was expelled in fragments. The latter were forced through the glandular canal connecting the tumor cavity with the uterine cavity. In the removal of the fragments and in subsequent manipulations the mucosa of the connecting canal and cervix were more or less destroyed.

## HERNIA THROUGH THE PELVIC OUTLET<sup>1</sup>

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Professor of Gynecology, Jefferson Medical College

THE bony outlet of the pelvis is closed by a musculo-membranous structure which is perforated in the female by three slits, or apertures, for the urethra, vagina, and rectum or anus. Within the pelvis are contained the bladder, uterus and its appendages, and the rectum. These structures are both suspended and supported. They are suspended by the folds of the peritoneum, fascia, the prolongation of involuntary muscular structure of the uterus in the uterosacral and uterovesical ligaments, and by the cardinal ligaments of the bladder. The support is afforded by the pelvic diaphragm or muscular floor of the pelvis, consisting of the levator ani and the peritoneal muscles which unite to form the tendinous structure known as the perineum.

These structures, which both supplement and complement each other, are situated one over the other in the pelvis. The fascia, which envelops and supports the muscles, forms in places strong resisting bands which reinforce the support. The vascular structure, connective tissue and large deposits of fat aid in forming a solid structure which promotes resistance. The disposition to displacement,

or hernia, is still further obviated by the inclination of the pelvis which takes it out of the line of direct or vertical intra-abdominal pressure. The relative positions of the uterus and vagina are also of importance as the line of vertical pressure on the posterior uterine surface is deflected against the most resisting portion of the pelvic floor, the tendinous perineum.

This brief résumé of the forces which combine to support the pelvic contents makes it evident that deviation from the normal inclination of the pelvis, or position of the uterus, injuries to the pelvic floor, relaxation of its muscular structure, overstretching of its fascia, loss of adipose or muscular tone, will conspire to the production of displacements and thus promote hernia. There are two points which may be considered weak in the normal construction. The first is in front at the base of the bladder between the tendinous arches, and the other, posterior in the space between the uterosacral ligaments and the muscular structure.

The disposition to protrusion at these points of material weakness is aggravated by the injuries incident to parturition, especially

<sup>1</sup>Read before the Chicago Gynecological Society, April 19, 1913

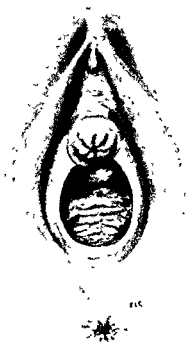


Fig 1 Urethral hernia or prolapse of the urethral mucosa

the loss of support associated with extensive laceration or muscular atrophy, by increased weight of the pelvic structures, or by exaggerated intra-abdominal pressure. The latter may be continuous, when produced by intra-abdominal growths or inordinate fatty deposits in the omentum and mesentery, transitory, from injudicious pressure of clothing, straining at stool, and severe exertion. Loss of support from extensive laceration, or loss of muscular tone associated with emaciation, especially following the climacteric, are likewise prone to cause downward displacement. When these forces are continued, as in retro-displacement of the uterus, lessened inclination of the pelvis with decreased support, or increased intra-abdominal pressure, the inclination to protrusion is exaggerated.

*Varieties.* These hernial protrusions may be divided into urethral, preuterine, uterine, postuterine, and rectal or anal. Two or more of these forms may be combined.

Urethral hernia may be either a prolapsus of the urethral canal or a protrusion of the mucosa (Fig. 1) and wall of the body of the

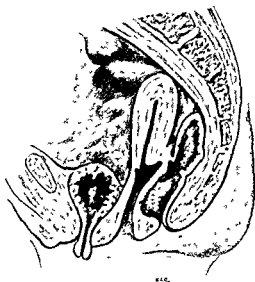


Fig 2 Vertical section of Fig 1

bladder. The protruding portion may be either so gripped or constricted by the urethra as to cause it to be oedematous, or even strangulated. Hernia consists of the mucosa and may involve one side of the canal or its entire circumference (Fig 2).

Preuterine hernia involves the bladder, and may be a sliding off from the symphyses, or the suspensory ligament may hold, and the base of the bladder drag. Such a condition is called a cystocele and may be associated with a prolapsus of the uterus, or where the body of the latter retains its place the cervix may become elongated. It is a frequent form of protrusion and soon results in a portion of the bladder being situated at a lower level than the inner orifice of the urethra. The resulting cystitis with its tenesmus increases the protrusion.

Uterine hernia is a protrusion of the uterus which as it comes down is covered with the vagina, but the lower portion of the vagina remains fixed. The eversion of the vagina is from above and the condition is known as uterovaginal prolapse.

Postuterine hernia is most frequently associated with laceration or overstretching of the perineum and may consist of a protrusion of



Fig 7

Fig 7 Rectum attached to the posterior parietal peritoneum at A and to the cervix at B, while the peritoneal surfaces laterally are sutured to close the retrouterine pouch below



Fig 8

Fig 8 Dotted line showing attachment of anterior parietal peritoneum over the fundus, which was fixed in the anterior abdominal wall

chanical measures, pessaries, served a very useful purpose, the usefulness of which, at the present day, is too frequently overlooked. It is essential that the displaced structure should be readily replaceable, the cervix healthy, and the pelvic floor so in evidence that it will afford the necessary support for the instrument. When the pelvic floor is lost the only relief by mechanical measures is the employment of a pessary with external support, but it irritates the vulva, causes pressure ulcerations in the vagina and on the cervix so that neither physician nor patient finds it agreeable and satisfactory.

The surgical measures are designed with three aims in view: first, to decrease the weight of the uterus, second, to combat the intra-abdominal pressure, and, third, to afford additional support. These aims may be accomplished by such slight measures as amputation of the cervix, and the simpler plastic procedures upon the anterior and posterior segments of the pelvic floor, or may require very extensive dissection and realignment of the pelvic structures. The her-

nia of the anterior vaginal wall and the bladder affords one of the most serious problems. The principal methods for combating this condition are those devised by Goffe, Watkins, and Dudley.

Goffe made a transverse or semilunar incision over the cervix, and from this, to near the external meatus, a vertical through the vaginal wall, separated the bladder from the vagina, in front of the cervix, and the anterior surface of the broad ligaments. Where, as was not uncommon, the uterus was retroverted, he secured a loop of each round ligament in front of the uterus, closed the peritoneum and stitched the bladder to the anterior surface of the fundus uteri and to the summit of each broad ligament.

After a similar dissection, Watkins drew down the fundus uteri, sutured the vesical layer of the peritoneum to its posterior surface, then sutured through the edges of the vaginal dissection and the anterior surface of the fundus so that the uterus subsequently occupied a position between the vagina and the bladder. This operation in Continental

Europe is called the Schauta-Wertheim operation, or vesicovaginal interposition. The redundant vaginal wall is resected before it is closed over the uterus.

This operation is applicable only to the sterile or artificially sterilized woman. Where the body of the uterus is large, or the cervix is long, it subsequently projects upward and backward, and thus favors the formation of a sacculated condition of the bladder in front of the fundus which endangers incontinence. This condition may be obviated in the one case by removing the large fundus, as suggested by Pfannenstiel. After the vesical peritoneum has been sutured to the posterior uterine surface at the level of the junction of the cervix and body, a keel-shaped amputation is made of the body, and the stump is secured beneath the contracted vaginal flaps. When the cervix is long, an amputation should precede the interposition of the uterus. After repeated operations, according to the plans suggested by Goffe and Watkins, I am more inclined to favor that suggested by Dudley for the amputated cervix. Swung on the lower sections of the broad ligaments, the lower end of the uterus is so raised that the fundus is thrown forward. None of these operative procedures is complete, however, without being supplemented by rectovaginal interposition of the levator ani muscles, a procedure which I have followed for the last six years and which has been described by Barrett, and has been especially emphasized lately by the work of Tandler and Halban. The procedure consists of raising a flap from the posterior segment of the pelvic floor by an incision around the posterior margin of the vulvar outlet from the remains of one caruncle myrtiform to the one on the opposite side. After the cicatricial tissue is cut through, the structures are separated by blunt dissection with the gauze wrapped finger. In marked cases the exposure should extend to the level of the spine of the ischii which will frequently require that the peritoneal floor of Douglas' pouch should be separated for a considerable distance. The edges of the levator ani muscle are united with continuous or interrupted catgut sutures. After these sutures are introduced and tied, the superficial tissues are

brought together with a row of sutures, the upper one of which is inserted at the left angle of the incision, carried across beneath the margin of the flap and brought out on the opposite side. This suture used as a tractor, others are inserted below it, making sure that the under surface of the vaginal flap is included in order to insure obliteration of dead spaces. Where the separation of the peritoneum is neglected it not infrequently constitutes a hernia which can protrude from the vulva over a well-interposed union of the levator ani muscles. This is particularly true in women who have passed the climacteric, are increasing in flesh and making strenuous efforts to maintain the same waist and hip measurements.

The operative procedure designated ensures a firm support and will in the majority of cases render unnecessary the opening of the abdomen for anchoring the uterus forward. In marked relaxation, however, the unanchored uterus is driven like a wedge through the newly constructed pelvic floor and should be maintained forward by the shortening of the round ligaments, and when the uterus shows a disposition to drag on its anchorage, by quilting together the peritoneum posteriorly, and thus shutting off the Douglas' pouch and at the same time raising up and holding back the cervix. Such a procedure places the uterus across the pelvic brim and utilizes it to control exit from the outlet.

In women who have passed the climacteric the uterus has become completely prolapsed, and the cervix and protruding vagina present extensive gravity sores, therefore, the operation of extirpation should be considered the procedure of election. The cervix should be drawn on with fixation forceps and an incision extended over the front of the vagina just posterior to the urethra, around the cervix, hugging the latter closely posteriorly. The bladder should be pushed back, the peritoneum opened in front, the broad ligaments ligated to secure the uterine and ovarian arteries. Following the removal of the uterus, the vesical peritoneum should be united with a continuous chromic catgut suture from side to side, making the line of suture vertical.



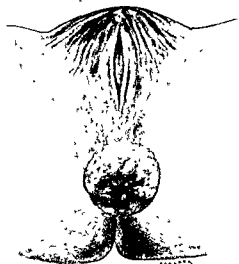


Fig 3 Rectal hernia consisting of prolapse of lower portion of bowel

the anterior rectal wall through a diastasis of the structures, or of a dissection between the vagina and rectum in which the peritoneum is pushed downward, and the sac with the intestines may appear at the vulva. In either condition the protrusion of the vagina is known as a rectocele when the anterior and posterior walls of the vagina thus roll out and become thickened, they drag upon the cervix, and a complete eversion of the vagina accompanied by the uterus, may occur, or where the fundus is fixed a hypertrophic elongation of the cervix may be caused. This form of hernia is generally denominated vagino-uterine prolapse.

Rectal hernia involves the anal outlet and may be an eversion of the lower division of the rectum with the anus (Fig 3), or that part of the rectum attached to and below the peritoneum may hold its place while the hernial protrusion is an invagination of the upper part of the rectum and sigmoid, or even of the descending colon (Fig 4).

**Diagnosis** The inspection of the pelvic outlet in the majority of the conditions named will be sufficient to differentiate the forms of hernia. The tubular projection of the urethra with its central opening continuous with

the external meatus distinguishes it from the less frequent protrusion of the bladder wall. The red or purplish oedematous protrusion misleads those seeing such conditions for the first time into the belief that it betokens malignancy, but careful consideration shows that it is due to the constriction. One such case came to me with the statement that a surgeon in charge of one of the state hospitals had refused to operate because he regarded it as malignant.

Inspection only is sufficient to differentiate cystocele and rectocele. In the vagino-uterine prolapse the vagina is everted; in the uterovaginal the finger can be passed into the vagina around the protruding mass. Such a condition can be differentiated from infravaginal elongation of the cervix, or pseudoprolapsus, by the relation of the vagina, and especially of the bladder to the protrusion. In complete eversion of the vagina it is desirable to determine whether procidentia is an accompaniment, which can be determined by grasping the protrusion with the hand, when, if procidentia, the uterus will be in the grasp of the hand, while in supravaginal elongation of the cervix the round cord formed by the cervix will be felt to rotate between the thumb and finger. The extent and cause of the rectocele can be

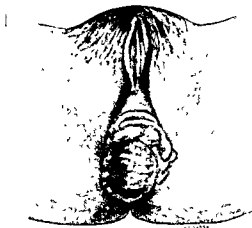


Fig 4 Invagination of rectum and sigmoid through anus and lower bowel, which remains intact

determined by hooking forward the finger introduced into the rectum.

Rectal hernia, when affecting the lower end of the bowel, is seen continuous with the anus and forms a wide protrusion, generally somewhat flattened, although I have seen such a condition which projected for over six inches. Intussusception may cause a tumor projecting for several inches from the anus resembling a polypus, the pedicle of which is constricted by the anal sphincter. Examination will disclose that the lower end of the bowel retains its normal relation.

*Treatment* No class of surgical cases offers more serious problems in their correction than are experienced in the treatment of the various forms of hernia through the pelvic outlet. The existence of many of these conditions indicates extensive changes in structure and relations which it is beyond possibility to restore again to normal conditions and environment. In urethral prolapse it would be folly to attempt to reduce the protrusion, for it would soon be reproduced. In

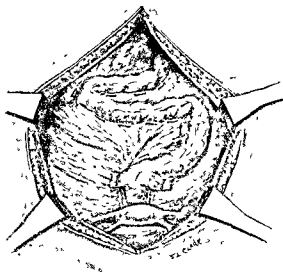


Fig 6 Rectum anchored by its mesorectum to the posterior parietal peritoneum, the sigmoid loosened and reattached below the cecum, while the intestine is sutured as it crosses and recrosses the pelvic brim

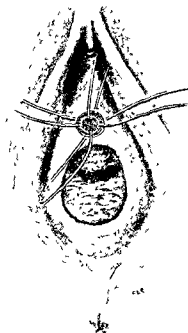


Fig 5 Prolapsed urethra excised and sutures introduced to unite the mucosa to the meatus

both the cases coming under my observation, I have severed the mucosa at the external orifice, and after drawing out the protrusion have cut it off and sutured the cut surfaces together (Fig 5). When the urethral orifice is enlarged it can be narrowed by removing a triangular section of the anterior margin of the outlet and suture this transversely, thus lessening the tendency to recurrence. The external orifice then becomes the narrowest part and supports the column above. In hernia of the bladder wall, the urethral canal is without question relaxed. The canal may be narrowed by a plastic operation on the vagina which compresses the urethra, but the necessity to evacuate the urine renders it difficult to provide against recurrence by mere tightening up the orifice. It may be necessary to secure the bladder wall higher on the surface of the uterus, or anchor it in front through an abdominal incision.

In the hernia through the middle orifice of the pelvic floor, the vagina, the problem of relief is frequently complex. When I came upon the professional stage, mechanical means were the only resource and all sorts of pessaries were devised. When there had not been too great loss of pelvic floor these me-



Fig 7 Rectum attached to the posterior parietal peritoneum at A and to the cervix at B, while the peritoneal surfaces laterally are sutured to close the retrouterine pouch below



Fig 8 Dotted line showing attachment of anterior parietal peritoneum over the fundus, which was fixed in the anterior abdominal wall

chanical measures, pessaries, served a very useful purpose the usefulness of which, at the present day, is too frequently overlooked. It is essential that the displaced structure should be readily replaceable, the cervix healthy, and the pelvic floor so in evidence that it will afford the necessary support for the instrument. When the pelvic floor is lost the only relief by mechanical measures is the employment of a pessary with external support, but it irritates the vulva, causes pressure ulcerations in the vagina and on the cervix so that neither physician nor patient finds it agreeable and satisfactory.

The surgical measures are designed with three aims in view: first, to decrease the weight of the uterus, second, to combat the intra-abdominal pressure, and, third, to afford additional support. These aims may be accomplished by such slight measures as amputation of the cervix, and the simpler plastic procedures upon the anterior and posterior segments of the pelvic floor, or may require very extensive dissection and realignment of the pelvic structures. The her-

nia of the anterior vaginal wall and the bladder affords one of the most serious problems. The principal methods for combating this condition are those devised by Goffe, Watkins, and Dudley.

Goffe made a transverse or semilunar incision over the cervix, and from this, to near the external meatus, a vertical through the vaginal wall, separated the bladder from the vagina, in front of the cervix, and the anterior surface of the broad ligaments. Where, as was not uncommon, the uterus was retroverted, he secured a loop of each round ligament in front of the uterus, closed the peritoneum and stitched the bladder to the anterior surface of the fundus uteri and to the summit of each broad ligament.

After a similar dissection, Watkins drew down the fundus uteri, sutured the vesical layer of the peritoneum to its posterior surface, then sutured through the edges of the vaginal dissection and the anterior surface of the fundus so that the uterus subsequently occupied a position between the vagina and the bladder. This operation in Continental

Europe is called the Schauta-Wertheim operation, or vesicovaginal interposition. The redundant vaginal wall is resected before it is closed over the uterus.

This operation is applicable only to the sterile or artificially sterilized woman. Where the body of the uterus is large, or the cervix is long, it subsequently projects upward and backward, and thus favors the formation of a sacculated condition of the bladder in front of the fundus which endangers incontinence. This condition may be obviated in the one case by removing the large fundus, as suggested by Pfannenstiel. After the vesical peritoneum has been sutured to the posterior uterine surface at the level of the junction of the cervix and body, a keel-shaped amputation is made of the body, and the stump is secured beneath the contracted vaginal flaps. When the cervix is long, an amputation should precede the interposition of the uterus. After repeated operations, according to the plans suggested by Goffe and Watkins, I am more inclined to favor that suggested by Dudley for the amputated cervix. Swung on the lower sections of the broad ligaments, the lower end of the uterus is so raised that the fundus is thrown forward. None of these operative procedures is complete, however, without being supplemented by rectovaginal interposition of the levator ani muscles, a procedure which I have followed for the last six years and which has been described by Barrett, and has been especially emphasized lately by the work of Tandler and Halban. The procedure consists of raising a flap from the posterior segment of the pelvic floor by an incision around the posterior margin of the vulvar outlet from the remains of one caruncle myrtiform to the one on the opposite side. After the clatrical tissue is cut through, the structures are separated by blunt dissection with the gauze wrapped finger. In marked cases the exposure should extend to the level of the spine of the ischii which will frequently require that the peritoneal floor of Douglas' pouch should be separated for a considerable distance. The edges of the levator ani muscle are united with continuous or interrupted catgut sutures. After these sutures are introduced and tied, the superficial tissues are

brought together with a row of sutures, the upper one of which is inserted at the left angle of the incision, carried across beneath the margin of the flap and brought out on the opposite side. This suture used as a tractor, others are inserted below it, making sure that the under surface of the vaginal flap is included in order to insure obliteration of dead spaces. Where the separation of the peritoneum is neglected it not infrequently constitutes a hernia which can protrude from the vulva over a well-interposed union of the levator ani muscles. This is particularly true in women who have passed the climacteric, are increasing in flesh and making strenuous efforts to maintain the same waist and hip measurements.

The operative procedure designated ensures a firm support and will in the majority of cases render unnecessary the opening of the abdomen for anchoring the uterus forward. In marked relaxation, however, the unanchored uterus is driven like a wedge through the newly constructed pelvic floor and should be maintained forward by the shortening of the round ligaments, and when the uterus shows a disposition to drag on its anchorage, by quilting together the peritoneum posteriorly, and thus shutting off the Douglas' pouch and at the same time raising up and holding back the cervix. Such a procedure places the uterus across the pelvic brim and utilizes it to control exit from the outlet.

In women who have passed the climacteric the uterus has become completely prolapsed, and the cervix and protruding vagina present extensive gravity sores, therefore, the operation of extirpation should be considered the procedure of election. The cervix should be drawn on with fixation forceps and an incision extended over the front of the vagina just posterior to the urethra, around the cervix, hugging the latter closely posteriorly. The bladder should be pushed back, the peritoneum opened in front, the broad ligaments ligated to secure the uterine and ovarian arteries. Following the removal of the uterus, the vesical peritoneum should be united with a continuous chromic catgut suture from side to side, making the line of suture vertical.

The inner or peritoneal surfaces of the broad ligaments are united with the same suture, exercising care that it raises up the prolapsed bladder, and the suturing is continued until the entire peritoneal wound is closed. The ends of the broad ligament stumps are made to approximate or overlap each other in the median line and particularly beneath the denuded bladder. The edges of the vaginal mucosa can then be united on a transverse line in the vaginal fundus, and by a vertical one in the anterior wall. This procedure should be supplemented by the rectovaginal interposition of the united levator ani muscles.

The rectovaginal interposition of the uterus has been suggested for the correction or control of rectocele but the necessary disturbance of the circulation and the nerve distribution, together with the weight of the organ associated, has made it seem to me an improper procedure.

The correction and prevention of hernia through the anal outlet present serious problems. One's first inclination is to consider it an indication of weakness of the sphincter, which should be made to stand more rigidly on guard, but the futility of this is appreciated when we consider that the function of this muscle is to relax and to facilitate the expulsion of any material coming against it, and no power to differentiate as to the character of the material is afforded it. It is true that a weakened sphincter may favor a hernia of the rectal mucosa and may consequently require to be tightened as a part of the procedure, but the chief aim should be that the bowel should not impinge against it. The operative procedures are necessarily divided into extra-abdominal and intra-abdominal, according to the situation of the hernial protrusion, whether of the lower end of the bowel or an invagination of the rectum or sigmoid.

In the first class where there is a redundant or prolapsed portion, a collar can be amputated and the edges sutured together something like an exaggerated Whitehead operation, but this has always seemed to me to endanger the sacrifice of the sphincter muscles. The sphincter is generally overstretched and no longer exerts a restraining influence on the contents of the canal. I have seen two cases

in which the eversion involved the lower part of the intestine, but in the first it was associated with an extensive prolapse of the rectum, so that the woman, a large fleshy person, sitting with either buttock on a chair and straining the bowel would form a tumor six inches long. A triangular section was removed from the anterior wall and a considerable section from the sphincter. The bowel was united with a double row of transverse sutures and the ends of the retracted sphincter united. The abdomen was opened, the intestine drawn up and sutured by a number of sutures to the side of the abdomen and to the abdominal incision. This patient was entirely relieved for a number of years but there was ultimately a recurrence, though to nothing like the former degree.

The second was a woman, aged 39, mother of six children in five pregnancies, who was twice operated on for laceration of the pelvic floor, by the late Dr. Joseph Price. When I saw her the effort of straining would evert the bowel, forming a projection about four inches in diameter. This projection would occur when much upon her feet, and, as she attended a small store, it was a source of continual distress. February 19, 1910, at the Jefferson Hospital, I cut through the vaginal septum into the rectum and removed a section of the anterior wall of the rectum extending some three inches up the canal, but instead of excising a section of the sphincter I overlapped its ends. In addition the cervix was amputated, the anterior vaginal wall split and retracted, pushing back the bladder and anchoring it higher on the uterus. A rectovaginal interposition of the levator ani was made. The abdomen was opened, the round ligaments anchored to the abdominal wall, the rectum drawn up and anchored on either side of the pelvis, and in closing the abdominal incision the uterus was sutured by its anterior surface which held it well out of the pelvis.

In February of the present year, two years later, she again entered the hospital complaining of a sensation as of the re-formation of a rectocele. The sphincter control was perfect, while she had none previously. There was no disposition to rectal protrusion but it was all confined to the postuterine structures

of the vagina. The vagina and perineum were opened to the sphincter, a projecting pouch of the peritoneum pushed back, and the levator ani muscles exposed and isolated at a higher level, when they were sutured in the middle line and covered by superficial sutures, which closed the exterior portion of the wound in the vagina and perineum.

In the second class of cases, where the lower two or three inches of the bowel retains its position, but an invagination of the sigmoid, or even colon, takes place through the anus, it would be useless to confine the operative procedure to the narrowing of the sphincter. Amputation of the hernial projection through the anus would be both ineffective and unsatisfactory. The removal of the prolapsed part from below would be almost impossible and the occurrence of a stricture would be endangered. Unless the anus has been overstretched it should not be disturbed, but the operative procedure should be an abdominal one. The intestine can be drawn up and the slack portion excised, or a lateral anastomosis may be done as suggested and practiced by McArthur of Chicago.

The resection of the intestines endangers the occurrence of a stricture at the site of the union while the anastomosis, unless the affected intestine is anchored, endangers its becoming dragged upon by the heavy loop.

The following history of one of my patients illustrates a method of procedure which may be employed in whole or in part in such cases.

Mrs. F., aged 37 years, the wife of a physician and the mother of two children, a strong, rugged woman, had suffered for several years from a protrusion of the bowel which obliged her to complete the act of defecation with the aid of a finger. When I examined her I found that the protrusion was an invagination which began at the point of insertion of the peritoneum over the bowel, while the hernia projected four inches from the anus. The anus, when the tumor was replaced, was sufficiently tight to prevent the escape of gas or liquid feces. The fixed point of the distal end was too high to permit of ready access for operative procedure from below.

While it is true that by splitting the anterior wall of the rectum through the sphincter into the vagina it would have been possible to have amputated the protruding mass, the soiling and infection of the peritoneal cavity would have been difficult to obviate, and besides the possibility of a stricture at the site of this amputation and the risk of imperfect union of the sphincter, together with a relaxed condition of the intestine above, made me feel it was wiser to leave intact the pelvic floor, and open the abdomen.

On the 18th of December, at St. Agnes' Hospital, a median abdominal incision was made, when it was found there was a long mesorectum and a deep retrouterine pouch. Passing the finger behind the uterus the rectum could be readily invaginated through the fixed portion at the bottom of this pouch, the rectum sigmoid and colon were loosely attached by the peritoneal fold. The rectum was drawn up, its peritoneal surfaces incised on either side as far back as could be done without endangering its vascular supply, the peritoneum spread out and sutured on each side to the posterior parietal peritoneum (Fig. 6), thus anchoring the rectum. The anterior surface of the rectum was sutured to the posterior surface of the cervix and the peritoneum on either side quilted together in such a way as to form a peritoneal floor and close the lower part of Douglas' pouch (Fig. 7). The intestine above this was so extensively convoluted as to make it a question how to dispose of the loop in such a way as to obviate the danger of fecal accumulation within it. The peritoneum on the outer side of the sigmoid was incised and the loop of intestine thus freed carried across and fastened beneath the end of the cæcum on the right side. The lower margin of this loop was sutured by catgut at several points as it thus passed across the brim of the pelvis. The upper portion of the loop was sutured to the base of the mesentery, and the intestines and omentum dropped over the loop. The appendix was removed. To insure still further security against prolapsus, after cutting the Fallopian tubes and suturing the uterine cornua to insure subsequent sterilization, the parietal peritoneum in closing the abdomen was carried around, sutured to the sides of the uterus, and the fundus brought up between the recti (Fig. 8), and secured to the under surface of the aponeurotic layer of the abdominal wall.

Aside from severe nausea for forty-eight hours following the operation, the patient experienced no unfavorable symptoms. She suffers less from constipation than prior to the operation, has experienced no inconvenience from the operative procedure, and is free from all symptoms associated with the former invagination.

# OVARIAN TUMORS COMPLICATING PREGNANCY, DELIVERY, AND THE PUERPERIUM<sup>1</sup>

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THE well-known discomforts, dangers, nutritional disturbances, and psychologic changes due to either pregnancy or the ovarian tumor are greatly augmented when the two conditions are coincident.

The position of surgical treatment for ovarian tumors alone is established, but obstetrical conservatism on the one hand and surgical aggressiveness on the other still leave the treatment of ovarian tumors during pregnancy, delivery and the puerperium an unsettled question. There has been, and still is, such variation of opinion that it has seemed not unwise to present a paper which will elicit an opinion from this society composed as it is, of surgeons interested in obstetrics, and obstetricians interested in pelvic surgery, for the guidance of the occasional operator.

Surgery of pregnancy is in the developmental stage. It has been hampered by many preconceived and erroneous notions, some of which are:

1. That the life of the child *in utero* has relatively little value.

2. That, when pregnancy is found complicated by pathology, the easiest and safest way to simplify matters is to terminate pregnancy.

3. That patients do not stand operations well during pregnancy.

4. That following operative procedure, abortions are to be expected.

5. That if pregnancy continues the child will be "marked."

More consideration is at present being given the child *in utero* by sociologists and obstetricians. We are more and more coming to believe that the child has rights a little more nearly on a par with the mother, and that, if the presence of pathology and the growth of the ovum clash, the pathology and

not the ovum should be removed or, if the removal of a growth would sacrifice the ovum, the growth should remain if it add only slightly to the mother's risk. Abortions have too frequently been performed for conditions which at the worst would only result in abortion. The child having rights, we should, in the presence of pregnancy complicated by a tumor, remember that we have two patients with one tumor rather than one patient with two tumors, not what is the easiest way to simplify a complex situation, but how best to do it to save both lives.

It is understood that a percentage of cases develop such complications during pregnancy that relief is imperative, but a considerable number of cases are seen at a time in which no symptoms force immediate action. It would seem proper that the discussion from this society, as well as evidence from the collected cases, should combine with statistics at hand to answer as far as possible the following questions:

1. Shall the ovarian tumor, discovered during pregnancy, be removed even though symptoms be absent, or only slight, or does obstetric conservatism demand the expectant plan of treatment?

2. Do the complications of delivery and the puerperium in the presence of ovarian tumor warrant an expectant plan of treatment?

3. Is there a certain period of pregnancy most favorable for operative procedure, for which we should wait, or which, if past, should compel the patient to go to term?

4. Which more greatly predisposes to abortion—the removal of an ovarian tumor, or its presence?

5. Does the removal of double ovarian tumor necessarily result in abortion?

6. Should the abdominal or vaginal route be chosen for removal?

<sup>1</sup> Read before the Chicago Gynecological Society, January 19, 1912. (See discussion, p. 106.)

7. Does tapping, puncture, or induced abortion relieve a complicated situation sufficiently to warrant such procedure?

In order that our conclusions may not represent opinions only, we have collected a series of one hundred and fourteen recent cases of ovarian tumors complicating pregnancy, labor and puerperium, including five cases seen personally, the results of which speak very decisively in answer to some of the important questions above.

In this series of one hundred and fourteen cases, seventy-six were operated on for removal of the tumor during pregnancy previous to full term. Of these seventy-six cases, seventy-three mothers recovered; one of those dying being the case of Ribblius, in which an exploratory puncture, without effecting the removal of the tumor, was made through the vagina in the sixth month of pregnancy, six days later laparotomy was performed, because of peritoneal symptoms, but the patient died from peritoneal infection. In the second case, the one of Clemenz, hæmorrhage occurred from the stump after the removal of a pedunculated tumor, a dead fœtus was removed the following day. Eighteen days after the operation an abscess of the parotid was opened and two days later death occurred. The third case, reported by Lobenstein, was operated upon in the sixth month of pregnancy, a laparotomy was performed and the fœtus extracted in a severe case of sarcomatosis, the patient dying three months after the operation.

It will be seen then, that in this series of seventy-six cases operated upon during pregnancy only one death of the mother occurred after an elected cœliotomy with removal of the tumor, this being the case of Clemenz, which suffered an accidental hæmorrhage with subsequent abortion, infection and pyæmia. Of the seventy-three cases that lived, sixty-three went to term. One case, that of Lehmann, had a hysterectomy, pregnancy not being suspected. This leaves only nine cases of abortion or premature delivery following single or double ovariectomy in seventy-three cases, and that notwithstanding the fact that many cases had torsion, infection, incarceration, etc., so that not infrequently the abor-

tion was merely the result of damage previously inflicted. We must decide for or against immediate operation, however, not alone by the results of the immediate operation, but by the results obtained by the expectant treatment. Of our series of one hundred and fourteen cases, thirty-eight cases were unoperated before term.

- 1 mother died before term (Kelly)
- 7 mothers were lost at term
- 7 children lost (1 pair of twins).
- 6 Cæsarean sections were performed (2 mothers died, 1 pair twins died)
- 7 cases no operation (4 mothers died).
- 7 vaginal ovariectomies (1 mother died, 1 child died)
- 3 vaginal punctures (1 mother died)
- 6 abdominal ovariectomies during labor
- 3 abdominal ovariectomies during puerperium
- 5 cases were operated in which route of operation is not mentioned
- 1 craniotomy

The results shown in the cases dealt with at term give overwhelming evidence in favor of dealing with the tumor before labor sets in. This shows a maternal death rate of 18.4 per cent as compared with 2.6 per cent in cases operated before term, leaving out the case that died from sarcoma, and even this small percentage is accounted for by an accidental hæmorrhage and an ill-advised method of operation, viz. vaginal puncture.

It cannot be claimed in justification of the greater mortality at term, that the most complicated cases were included in this list, for it would be the least complicated cases that would not demand earlier attention. Very slight difference is shown in the foetal mortality, but here again the waiting treatment is more at fault than is at first apparent, for in several instances the expectant treatment resulted in such damage that abortion followed an operation during pregnancy. Add to this high maternal and foetal mortality of the expectant treatment, the fact that only seven of the thirty-eight cases escaped operation, and that four of those seven died and the remaining three still have the tumor with which to contend, and it would seem that there is little to recommend this form of treatment.

A study of our series as to the time of the operation, reveals the following:



Forty-four cases are recorded operated during first half of pregnancy, three abortions, no death of mother.

Eighteen cases are recorded operated during second half of pregnancy, four abortions, death of three mothers.

Fourteen cases, time not recorded, two abortions, no death of mother.

This would indicate again the advisability of early operation, the expectant treatment being responsible for the poorer results during the latter half of pregnancy. The results during the latter half, however, are so far superior to results at term, as to warrant removal of the tumor during this period.

A study of the cases of double ovarian tumor shows that out of eight double ovariectomies six went to term, this evidence contradicting the opinion that pregnancy cannot continue without corpus luteum. The slightly higher rate of abortion in double ovariectomies in our series, as well as in that of others, leaves us in doubt as to whether the presence of ovarian tissue has a beneficial influence upon pregnancy, or whether the increased injury incident to the presence of two tumors, and then the removal of two, does not account for this increased percentage of abortion.

My personal experience with ovarian tumors during pregnancy is limited to five cases.

CASE 1 Mrs R, seen in the P & S College clinic. Patient brought in in collapse from rupture of pelvic tumor. Pregnancy not diagnosed before operation, but suspected at time of intra-abdominal examination. Fluid and sac of left ovarian tumor removed. Pregnancy went to term.

CASE 2 Mrs W Multipara, had worn pessary after birth of last child for retrodisplacement. Patient pregnant 2½ months, and presenting symptoms of incarceration with threatened abortion. Bimanual examination revealed tender, incarcerated, pregnant uterus and left ovarian tumor. Abdominal operation was done, the cyst and sac with fluid were removed, the uterus freed, and the round ligaments shortened. Pregnancy continued to term.

CASE 3 Mrs S Multipara. History of tumor complicating last childbirth and puerperium, but which had given little trouble since, until last two months. Examination revealed a two-fist sized mass in the pelvis, closely attached to the uterus which organ was crowded upward and to the left. Abdominal operation revealed infected dermoid of right ovary so closely connected with the uterus that the uterus had to be stitched upon removal of

the tumor. Abdomen closed with wick drainage, which was removed in 36 hours, as recovery was without rise in temperature. Pregnancy continued to term, and patient when last seen was again pregnant.

CASE 4 Mrs S. Multipara; 4½ months pregnant. Gives history of mass felt for four or five years, but giving no trouble. Hard working woman, was helping husband to unload a carload of coal, when severe pain came on. When seen several days later, patient anxious in appearance and extremely sick, but with moderate temperature. A large, firm mass was felt in upper left quadrant of the abdomen. Bowels greatly distended with gas. Pregnant uterus occupying lower part of abdomen. Ovarian tumor with twisted pedicle complicating pregnancy and with secondary peritonitis was diagnosed. Operation revealed free fluid, bowels distended and markedly injected. Tumor gray-blue-black in appearance and pedicle with complete twist. Tumor size of a head, easily removed without puncture. Abdomen closed with drainage. Recovery uninterrupted, pregnancy going to term.

CASE 5 Mrs J, doctor's wife. Seen in consultation with Dr Steele. Patient greatly emaciated and reduced in strength, but presenting great distention of the abdomen. Large ovarian tumor with pregnancy 6 to 7 months diagnosed and operation advised, which was done by Dr Steele assisted by Dr Davison. Premature delivery followed within 18 hours. Patient recovered. Abortion undoubtedly due to previous compression.

The results shown in our series are substantiated by the statistics of others as follows.

Patton collected ninety-five cases treated expectantly, thirty-one cases treated by puncture, and one hundred and eighty-four cases treated by abdominal section. The ninety-five cases treated expectantly, for fear of interrupting pregnancy, resulted in twenty-five maternal deaths, four of which were in cases operated on after labor, and twenty-one not operated on at any time. Twisted pedicle was observed twenty-nine times, four before labor and twenty-five during the puerperium. Rupture of cysts occurred in thirteen instances, three before and ten during or after labor. Suppuration was observed six times during the puerperium. Pregnancy was interrupted in 18.9 per cent of the cases. Mortality in cases not operated on at all, 45.6 per cent, mortality in cases operated on after delivery, 8.1 per cent. Patton's cases treated by puncture or tapping showed a maternal mortality of 18.7 per cent, and

interruption of pregnancy in 54.8 per cent of cases. His one hundred and eighty-four cases treated by abdominal section showed one hundred and seventy-six recoveries with eight deaths, a mortality of only 4.3 per cent in spite of the fact that forty-six cases had twisted pedicle and some of them were in desperate condition. Interruption of pregnancy occurred in 19 per cent of the cases, which may be charged largely to complications. His 18.9 per cent of interruptions in cases treated expectantly, leaves the other 81.1 per cent to contend with the ovarian tumor at birth.

Nystroem from Engstroem's clinic in Helsingfors reports one hundred and eleven cases of ovarian tumors and pregnancy without operation, in 25 per cent of which interruptions occurred. Of 37 cases operated on 13 per cent were followed by abortion.

Sahnwald of the clinic in Breslau collected thirteen cases of ovariectomy during pregnancy with not one maternal death and only two abortions. (10.02 per cent)

Flatau gives statistics of two hundred and eighty-four cases of ovariectomy during pregnancy collected from the literature of 1892 to 1905. In forty cases or 17.2 per cent pregnancy was interrupted. Two of these interruptions were criminal abortions performed after the operation. In two other cases the foeti were macerated when delivered twenty-four hours after the operation. In one case the pregnant uterus was taken for a tumor and punctured. In two cases the abortion took place ten and twelve weeks respectively, after operation. These cases were left out and the statistics are then as follows:

Two hundred and seventy-seven ovariectomies with forty-two abortions or 15.1 per cent. The statistics further show that in many cases, not the ovariectomy, but a more or less number of complications were the cause of interruption of the pregnancy. One case was complicated by "adenoma capillare" and adhesions. Four cases of dermoids were found, two of them bilateral. In two cases the tumors were ruptured during operation, most likely as a result of technical difficulties. Two cases were purulent and

one of them intraligamentous. Six cases had torsions and one case was complicated with pleuropneumonia. Thirty-nine cases of bilateral tumors were operated on and thirty-two came to term, two of the cases interrupted were bilateral dermoids, one complicated with hyperemesis and one had a second laparotomy for severe hemorrhage.

Petri cites a case of Essen-Müller in which extirpation of both ovaries with the corpus luteum was followed by normal delivery of a living child at term, two hundred sixty days after operation. Petri thinks that implantation of the ovum and continuation of the pregnancy do not depend upon the corpus luteum, and that normal ovarian tissue is necessary for implantation only, after which pregnancy may continue even though both ovaries be removed.

Spencer reports forty-one cases, twelve of which were operated on during pregnancy and the remainder during the puerperium. Of the twelve cases operated on before delivery nine were operated during the first half of pregnancy and two of these aborted, both having double tumors removed, although enough ovarian tissue remained in one case, so that the patient had a succeeding pregnancy and went to term.

Spencer's forty-one cases had torsion fourteen times, this large percentage undoubtedly being due to so many of his cases having been dealt with during the puerperium.

McKerron found torsion in 12.5 per cent of one thousand, two hundred and ninety ovarian tumors at large, but found torsion in 30.4 per cent of cases during the puerperium.

From these statistics we cannot fail to be impressed with the fact, that the usual hazards of ovarian tumors, namely: pressure, rupture, hemorrhage, torsion, suppuration, etc., are greatly increased with the onset of pregnancy, some of them being still more increased during labor, and are well-nigh appalling during the puerperium. To these hazards must be added the interferences to pregnancy and labor. They show such results with appropriate treatment, that abortion for simplification, or tapping for temporizing is unwarranted, or, to be liberal, rarely justifiable. They show with convincing evidence, that celiot-

omy with ovariectomy, even double, is followed by abortion only slightly in excess of the damage already done, prevents abortion from further damage, and brings the patient to labor at term, uncomplicated by presence of a tumor

They show that if the temporizing treatment is pursued many patients will abort, many will develop complications during pregnancy, and the remainder are brought to labor with the tumor present, making operative procedure common, and should delivery be accomplished, the patient but enters the most hazardous period, the puerperium. Spencer and others recommend that celiotomy be performed immediately after delivery on account of the extreme danger of the puerperium

Time will not permit a discussion of the differential diagnosis, but a few points may be mentioned. Literature abounds with instances in which the sound has been used to differentiate between pregnancy and tumor or other conditions, but this shows a disregard for the child which belongs to another age. Usually a careful investigation will determine the presence of pregnancy and a complicating condition. In the absence of urgent symptoms careful observation is to be recommended. With urgent symptoms pregnancy and a surgical condition is suspected which will lead to exploration

During pregnancy an ovarian tumor may be so high as to be misinterpreted for hydronephrosis, or tumor of the kidney, spleen, pancreas or liver. Sometimes in doubtful cases the X-ray may help to determine the presence of pregnancy and a shadow-producing material on the surface may show the fetus not occupying the whole tumor

In conclusion I would say

1. That pregnancy frequently takes place in the presence of ovarian tumors, even though both ovaries be involved

2. That with the onset of pregnancy we have two patients with one pathological condition, rather than one patient with two pathological conditions, each with claims upon their constitutional rights to "life, liberty, and the pursuit of happiness."

3. That the growth of the ovum produces

such changes in position and structure of ovarian tumors as to make it a menace to the child and mother during pregnancy, that extra hazards occur during labor and are at their height for the mother during the puerperium

4. That induced abortion with its one hundred per cent of child mortality is unjustifiable, in that it offers no corresponding improvement in the condition of the mother.

5. The early removal of the tumor as soon as possible after its discovery, gives a high percentage of good results in both mother and child and removes the hazard during labor and the puerperium

6. That abortion following ovariectomy any time during pregnancy is in proportion to the damage already done.

7. That tapping or puncture of the tumor shows too large a mortality to make them justifiable procedures, except as preliminary expedients in rare cases.

8. That the danger of abortion after double ovariectomies is not sufficiently great as to call for other treatment than that accorded the single tumor.

9. The results during the latter half of pregnancy are such as to warrant removal of the tumor rather than to let the patient continue to term, the increased percentage of abortion being due largely to increased damage previous to or during operation

10. A patient in labor with a complicating tumor should be placed in the most favorable surroundings possible, and labor allowed to terminate if unobstructed. This should be facilitated by the use of forceps, if labor is at all difficult and the tumor located well above the pelvis; position and manual efforts may change a pelvic obstructing tumor into an abdominal non-obstructing one.

11. Tumors interfering with labor pains, or located so as to obstruct the outlet or presenting torsion, hemorrhage, or suppuration, thus offering immediate abdominal complications, may be operated upon with Cesarean section accompanying, or, if the outlet is adequate, as shown by previous easy labor, or by liberal measurements, and the soft parts well dilated, labor may be allowed to continue, after the removal of the tumor.

12. Vaginal Cæsarean section may be performed in some instances with inertia.

13. Vaginal puncture of an obstructing tumor may rarely be permissible, but should be followed by vaginal or abdominal removal before or after labor, as puncture with non-removal shows high mortality.

14. In all operative procedures during pregnancy great care should be taken in manipulations of the uterus.

15. The uterus shows such toleration, however, that necessary handling, even to stitching, need not be feared.

16. On account of the great risk of torsion and degenerations during the puerperium, an ovarian tumor should be removed as soon after labor as the patient's condition and surroundings will warrant. If delay is necessary, the tumor should be closely observed

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## UNILATERAL KIDNEY HÆMORRHAGE WITH REFERENCE TO SO-CALLED ESSENTIAL HÆMATURIA

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**I**N a previous communication on the subject of so called essential hæmaturia, I called attention to the fact that the class of cases to which the term "essential hæmaturia" can now be applied are seen very rarely if at all (41)

The writings on this subject have been numerous and voluminous since the appearance of the above-mentioned publication, and in an overwhelmingly large number the various authors' views coincide with the views as expressed in the above-mentioned paper.

This rapid disappearance from our renal nomenclature of the phrase "essential hæmaturia" is due to the following factors

- 1 The universal employment of the cystoscope and ureteral catheter, by means of which one can more correctly diagnose the origin of the hæmaturia, a procedure much neglected in former case reports

- 2 The more routine removal of pieces of the kidney at time of operation for histologic diagnosis

3. Pyelotomy in cases of suspected lesions of the pelvis or calyces

- 4 Bacteriologic examination of the urine obtained from each kidney separately by means of the ureteral catheter

- 5 Careful and complete physical examinations

- 6 Routine employment of the X-ray

Before taking up these factors in detail and discussing the recent literature on this subject, I wish to report the following case:

A C, aged 45 man, married

*Previous History* About five years ago the patient had his first attack of hæmaturia, which extended over a period of about nine months. There was blood in the urine with each micturition, but no frequency of urination. Associated with the hæmaturia were cramp like pains in the right upper quadrant of the abdomen. In the beginning these pains were so severe that the patient was obliged to call a physician during the night. The first attack of pain quickly subsided and he was free

from pain for three months, although the hæmaturia continued during this time. At the end of the three months he was again seized with cramp-like pain in the right upper quadrant of the abdomen. Six months later he had a third attack of right sided pain. He then entered the service of Dr. Bevan at the Presbyterian Hospital seeking relief from the hæmaturia, which had now continued for about nine or ten months.

*Examination* At this time I cystoscoped him with the following result. Bladder capacity 12 ounces. The bladder mucosa was pale but otherwise normal. From the right ureteral orifice bloody urine was being emitted in spurts. From the left ureter clear urine was emitted. A diagnosis of right-sided hæmaturia was made.

*Operation* The patient was operated on by Dr. Bevan, who did a decapsulation operation. The patient made an uneventful recovery. There was immediate relief from any further attacks of pain, but the hæmaturia remained uninfluenced by the decapsulation, as the bloody urine continued for ten months after the operation.

He then remained free from symptoms for about three and a half years, when the hæmaturia returned. This attack of hæmaturia was also continuous, the urine being bloody all of the time, the patient, however, was more free from pain, there being only mild attacks in his left side. He re-entered the hospital and I again cystoscoped him for Dr. Bevan. The bladder was normal. The ureteral orifices and the internal urethral orifices were normal. From the left ureter bloody urine was emitted. The patient left the hospital and was not seen again until he entered the genito-urinary department of the Alexian Brothers' Hospital, having been referred to Dr. Louis E. Schmidt by Dr. F. A. Rettig.

*Physical examination.* Head and neck, eyes react to light and accommodation; tongue is coated, posterior cervical glands enlarged. Thorax, heart and lungs negative. Abdomen: on deep palpation a sensitive spot was found one half inch to the right of the umbilicus,—there were sensitive areas along the right costal arch and above the pubes, genitalia, negative, nervous system, negative. Rectal examination, prostate small, otherwise negative, right seminal vesicle sensitive, left seminal vesicle negative. Cystoscopy. Mild degree of generalized trabeculation, internal urethral orifice negative, left ureteral orifice congested and gaping, emitted bloody urine; right ureteral orifice negative.

Double ureteral catheterization. The catheters pass up into the pelves of both kidneys without any obstruction

Right	Left
Clear	Bloody
Acid	Acid
Albumin trace	Albumin
Few red blood-cells	Many red blood-cells
No pus cells	No pus-cells
No casts found	No casts found
— $\Delta$ 1.07	— $\Delta$ .98
Urea 1 per cent	Urea 0.7 per cent
Phenolsulphonephthalein test appeared in 4½ minutes, excreted 28.09 per cent in one hour	Phenolsulphonephthalein test appeared in four minutes, excreted 37.5 per cent in one hour

Cryoscopy of blood, = - 56 Blood cultures were sterile Urine cultures were sterile

Blood count. Red cells, 3,360,000 White cells, 11,500 Hæmoglobin, 65 per cent Sputum examination. No tubercle bacilli found, urinary examination for tubercle bacilli was negative. Blood-pressure Right arm, 122 mm, left arm, 118 mm X-ray examination was negative

Because of the long duration of the bleeding, of failure to check the hæmorrhage by medical treatment, and, in view of the negative physical findings, it was decided to operate on the left kidney, as it was conclusively proven to be the source of the hæmaturia

*Operation, December 13, 1911 (Dr. L. E. Schmidt)* The kidney was exposed through the usual oblique lumbar incision. The surface of the kidney was irregular, showing many scars and retractions of a moderate degree. In spots, here and there, the capsule had the appearance of thickening. There was no marked change in the color of the kidney. Decapsulation, with excision of a piece of kidney tissue for microscopic examination, was done. The wound was closed in layers and a cigarette drain inserted which was removed at the end of twenty-four hours

*Postoperative course.* Immediately after the operation all blood disappeared from the urine, so that the urine was clear. No red blood cells were found in the centrifugized specimens examined at regular intervals during the patient's stay in the hospital, "nor were any casts found." Convalescence was uneventful except for a slight catgut infection

#### HISTOLOGIC EXAMINATION

The glomeruli presented various changes. In some there was an increase in the nuclei which stained rather deeply. Some of the glomeruli showed vacuolization of the cells covering the Malpighian tufts. The most characteristic change in the glomeruli was the connective tissue change. This was variously increased; in some of the glomeruli there was

only a slight connective tissue thickening of Bowman's capsule; other sections showed this change more advanced, so that the entire glomerulus had undergone complete fibrosis. A few of these glomeruli were surrounded by areas of round-cell infiltration.

The tubules showed various changes of degeneration, in some instances having gone on to complete necrosis. The lumen of the tubules contained a coagulated material. In others the lumen was completely filled with necrotic epithelial cells.

The blood-vessels showed in many sections quite a marked thickening and in one area a well-developed encroachment of the thickened walls onto the lumen.

There was no increase in the interstitial connective tissue. The previously described areas of round-cell infiltration were limited to a few glomeruli.

The interesting features of this case are:

1. The long-continued duration of each attack of hæmaturia.
2. The relatively long time between the two attacks
3. The prompt cessation of the bleeding following the decapsulation.
4. The very evident gross and microscopic changes in the kidney.
5. Absence of albumin and casts in the urine in the presence of marked nephritic changes in the kidney. (Postoperative examination).

It is unnecessary to go into the details of cystoscopy and ureteral catheterization at this time. It is quite apparent that this is the most accurate method at our command which furnishes definite data regarding the origin of the blood. No one nowadays would diagnose a painless hæmaturia as a case of "essential hæmaturia," unless a cystoscopic examination has first been made. Still, one finds in the literature, case reports of "essential hæmaturia," in which no cystoscopic examination has been made. This group of cases is further narrowed down by the employment of more recent additions to our diagnostic armamentarium, namely, the X-ray, the shadographcatheter, and pyelography.

The more routine removal of pieces of kidney tissue for diagnosis has done more

Schenck (60) says that "until some competent observer reports a case in which there is no doubt but that the hæmorrhage was from the kidney and that the kidney was normal in every part, as demonstrated by serial sections, we are justified in believing that idiopathic or essential hæmaturia does not exist."

To this I would add the exclusion by cultural methods of infection by *B. coli communis* and possibly other micro-organisms.

Katzenberg (39) is of the opinion that the cases of profuse kidney hæmorrhages, described as essential kidney hæmorrhage, are caused by beginning nephritic processes that are especially marked in the cortex and capillaries that cannot be demonstrated macroscopically, that can only be demonstrated microscopically by a most careful examination of pieces excised from various parts of the kidney.

Even though the patient had been cystoscoped and the origin of the blood had been determined by the ureteral catheter, and if such a patient is operated on, several facts should be borne in mind:

1. That often to gross inspection a kidney may appear normal and on histologic study it may show marked inflammatory or degenerative changes.

2. That if the kidney appears normal and the microscopic sections do not show pathologic changes, perhaps we have overlooked a lesion in the renal pelvis.

Hence it might be advisable at times to perform a pyelotomy. The existence of lesions of the renal pelvis, in as much as they are usually devoid of subjective symptoms, may escape detection and be recorded as cases of essential hæmaturia. Lesions of the renal pelvis associated with hæmaturia have been well described by Guibe (29), Karaffo-Korbitt (36), McGowan (48), Peterkin (54), Pilcher (55), Zimmer (72), and Von Frisch (22).

Zimmer speaks very strongly for vessel changes in the pyramids in those cases in which the parenchyma of the kidney is normal, and he also calls attention to a publication of Guthrie on this subject as far back as 1902.

In his two reported cases he is inclined to look upon them as cases of essential hæma-

turia, although he could not fulfill the dictum that before diagnosing essential hæmaturia the entire kidney must have been examined after serial sections had been made. He is inclined to believe, however, that in those cases in which the excised piece of kidney tissue does not show any nephritic changes, anomalies of the blood-vessels of the pyramids may be the cause of the bleeding. These vessel changes may be arteriosclerotic in nature, dilatation of the small vessels or angiomatosis of the papillæ.

Von Frisch (22) found a pyelitis granulosa in one of his hæmaturia cases.

In some of the cases, lesions both of the pelvis and the kidney were found—Keefe (37), Haynes (32), Karaffo-Korbitt (36).

Fullerton (23) found macroscopic changes in the form of adhesions, although he believes his case to have been one of hæmorrhagic nephritis.

From the literature at my command I have collected reports of eighty-two further cases not included in my previous report (41), variously described in the literature. Of this number histologic reports were found of twenty-seven cases. In five of the twenty-seven cases there were no histologic changes. In three of these five cases—Graff (28), Warren (68), Zimmer (72)—an excised piece of kidney was examined and found normal. This does not prove them to have been cases of essential hæmaturia as by excision the pathologic process may have been missed as well as having overlooked lesions of the pelvis. In the other two cases—Steinthal (65) and Reifferscheid (58)—nephrectomy was performed in each case and the entire kidney was subjected to a histologic examination without finding any pathologic changes. "In the remaining twenty-two cases, changes of a nephritic nature were found."

Ballochs' (3) case is interesting because of an occurrence of painless hæmaturia with several pregnancies. Nephrectomy; microscopic examination showed changes of a granular kidney. The patient subsequently became pregnant again. This pregnancy was accompanied by hæmaturia which disappeared after the child was born.

Fowler's (20) second case is interesting

because of the multiplicity of the histologic changes found on microscopic examination.

### CONCLUSIONS

1. Unilateral renal hæmaturia does not always mean unilateral disease, as one may be dealing with a bilateral lesion although only one side may be bleeding at the time of examination.

2. Absence of albumin and casts in the urine does not exclude the presence of nephritic changes in the kidney.

3. Cystoscopy and ureteral catheterization must be employed in each case to determine definitely the renal origin of the blood.

4. Histologic examination of several pieces of excised tissue or preferably of the entire kidney must be made in every case before a diagnosis of essential hæmaturia can be made.

5. Cultures of catheterized specimens of urine from each kidney, to determine a possible bacterial cause for the hæmorrhage, must be made in all obscure cases.

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perhaps than any one factor in disproving the theory of "essential hæmaturia." This should include, of course, those cases in which a nephrectomy has been carried out and histologic examinations of the kidney have been made. A report of the histologic findings settles the diagnosis in the largest number of cases. But in cases in which the histologic report of an excised piece is negative, we must reckon with the possibility of a localized process or processes in the kidney which were not included in the excised piece of tissue, or of a lesion in the renal pelvis.

In my previous paper, I dealt with the reports of 130 cases, sixty two of which had had a microscopic report, fifty three cases showed various nephritic changes (41).

The more carefully these cases are studied, the fewer are the cases which in the future will be called 'essential hæmaturia'.

Recently a bacterial phase has been added to the question. It has been suggested at various times whether or not so called essential hæmaturia might not be the result of infection by the colon bacillus. Billings (5) reports two interesting cases bearing on this subject.

CASE 1. A woman aged 21 had had intermittent hæmaturia for six years or more. A moderate pyuria existed. The urine obtained from the right kidney per urethral catheter contained pus and *B. coli communis*. Operation Nephrectomy. The mucosa of the pelvis was congested and thickened. A small section of kidney removed for histologic study showed interstitial nephritis. Disappearance of the hemorrhage after injections of colon vaccine.

CASE 2. A physician aged 58, was suffering from a right sided hæmaturia. A specimen of urine was obtained from the right kidney per urethral catheter. This contained a pure culture of *B. coli communis*. Disappearance of the hæmaturia after the third injection of colon vaccine. No more bleeding.

A Elliott (18) also considers the possibility of *B. coli communis* inducing painless hæmaturia in his report of a case of toxic hæmaturia.

"The type of toxæmia observed during the hæmaturia was distinctly gastro-intestinal. It became apparent on investigation of this point that it was possible to induce hæmaturia by directing the patient to eat freely of all red meats at the same time neglecting the bowels, which were somewhat torpid. Under these conditions headache, backache, and fever would appear and the urine would become

concentrated and found to contain blood, albumin, and casts. A mercurial laxative coupled with a non-proteid diet never failed to control the symptoms, and so long as meats were avoided or consumed in strictly moderate amounts, there was no recurrence of the toxæmia and the hæmaturia. In this case there is established a direct connection between the hæmaturia and a toxæmia induced by the ingestion of meats, in all likelihood a *bacillus coli communis* activity. It may even be possible that the kidneys during these periods of severe hæmaturia were the seat of an acute bacterial invasion. Such an event may be more common than we at present realize. We may, perhaps, be justified in assuming the ability of an acute bacterial infection of the kidneys to cause hæmaturia."

In his article on hæmaturia, William Hale White (69) also mentions a bacterial factor in the production of hæmaturia. "It is, perhaps, conceivable that the trouble is due to the passage of bacteria from the blood through the kidney into the urine. This must be settled by future investigation, but it must be remembered that in two of Katzenberg's cases the urine was examined bacteriologically without finding any micro-organisms."

The bacterial factors in the production of hæmaturia will naturally lead us to ask whether or not many of the previously reported cases of essential hæmaturia in which no cause could be found for the bleeding were not due to infections by the colon bacillus or perhaps other micro-organisms.

Aside from the bacterial origin of painless hæmaturia, the largest number of cases are due to inflammatory or degenerative changes in the kidney. This for the reason already stated earlier in this paper.

In a contribution to the etiology of unilateral nephritis, Gaudiani (25) comes to the following conclusions. "From our present knowledge we must assume that the so-called 'hemorrhagic nephralgias' are always called forth by some severe lesion of the kidney. With the exception of cases of tuberculosis, stone, tumor, torsion of the pedicle, or Bright's disease, all cases described as hemorrhagic nephralgia are due to circumscribed inflammatory processes and are cases of so-called unilateral nephritis. Pathologic experiments and clinical observations permit the conclusions that many of these lesions are the result of bacterial invasion of the kidney."

Golling (26) also favors an inflammatory origin of the bleeding "Renal hæmaturia not produced by the usual causes, stone, tumor, tuberculosis, is seen in hæmophilia, strains, traumatism, pregnancy and movable kidney. Usually the hæmaturias are produced by nephritic changes, not presenting uniform anatomic pictures, and hence cannot be more accurately defined. The absence of albumin and casts does not exclude nephritis."

DeVaux (16) states that most authorities to-day are of the opinion that a so-called essential hæmaturia does not exist. With few exceptions the kidneys extirpated for severe hæmorrhages show changes histologically. It is true that in some of the cases the changes were so slight that some authors, notably Caspar, do not look upon any causal connection between the bleeding and the histologic changes. DeVaux further states "If the urine from the non bleeding kidney is normal it does not prove that this kidney is intact, because nephritis does not have to produce albumin and casts."

The statements of Golling, DeVaux, and others, that nephritis does not have to produce albumin and casts, are borne out in the above-reported case. Since leaving the hospital, I have had occasion to examine the patient's urine. There was no albumin, casts, or blood present, although from the above-mentioned histologic findings he has a badly damaged kidney.

The fact that only one side bleeds at the time of examination or at repeated examinations does not exclude the existence of a lesion in the other kidney. By referring to the history it will be seen that his two attacks of hæmaturia were four years apart and that only one side was bleeding at the time of operation; the opposite kidney was secreting a urine devoid of any characteristic changes upon which a diagnosis of nephritis could have been made.

That both kidneys may be involved to the same extent by the same pathologic process and still only one be the source of active bleeding has been reported by others—Lane (2).

In a case previously reported I had the opportunity of witnessing this phenomenon. Briefly the case was as follows:

A S., aged 22, had had a painless hæmaturia of five months' duration, during which time his urine was never free from blood. The only pain of which the patient complained was in the upper left quadrant of the abdomen, which had persisted for about three weeks.

*General examination.* Temperature 101, pulse 100. Marked pallor of the skin and mucous membranes. The heart distinct apical pulsation in the fifth interspace, high accentuation of the second pulmonic, a mitral murmur and a slight murmur of aortic insufficiency. Abdomen liver palpable below the costal arch, and a tumor mass in the left side was found. Marked cyanosis of the finger- and toe-nails.

Cystoscopically, bloody urine was being emitted from the left ureteral orifice and clear urine from the right. The first urinary report showed blood and albumin, no casts. The second urinary examination showed a few granular casts.

At this time, a tentative diagnosis of tumor of the left kidney with bleeding was made. It was then decided to inflate the colon. Colonic distention showed the tumor mass to be anterior to the colon, thereby demonstrating that the tumor was not of renal origin, but was splenic. The hæmaturia persisted up to the time of the patient's death.

*Post-mortem examination.* Chronic endocarditis of the mitral valve, enormously hypertrophied heart, cyanotic induration of the liver, chronic splenic tumor with infarcts and a bilateral hæmorrhagic nephritis.

This case demonstrates that although both kidneys may be equally diseased by the same pathologic process, only one may be actively bleeding during the period of observation.

Karaffo-Korbutt (36) believes that hæmorrhages from healthy kidneys without a pathologic basis appear to be very improbable. His case showed, besides nephritic changes, lesions of the renal pelvis.

Maiocchi (47) comes to the following conclusions: "A study of essential hæmaturia, in the sense of bleeding from a normal kidney, is not substantiated either by clinical or by pathologic observations. In practically all cases of so-called 'essential hæmaturia' inflammatory or degenerative changes are found."

Motz (49) also believes in an inflammatory origin of the bleeding: "Frequently the hæmaturia is produced by lithiasis, tuberculosis, or tumor. In the larger majority of cases, however, the bleeding arises as a result of an interstitial and a glomerulo-nephritis."

Schenck (60) says that "until some competent observer reports a case in which there is no doubt but that the hæmorrhage was from the kidney and that the kidney was normal in every part, as demonstrated by serial sections, we are justified in believing that idiopathic or essential hæmaturia does not exist."

To this I would add the exclusion by cultural methods of infection by *B. coli communis* and possibly other micro-organisms

Katzenberg (39) is of the opinion that the cases of profuse kidney hæmorrhages, described as essential kidney hæmorrhage, are caused by beginning nephritic processes that are especially marked in the cortex and capillaries, that cannot be demonstrated macroscopically, that can only be demonstrated microscopically by a most careful examination of pieces excised from various parts of the kidney

Even though the patient had been cystoscoped and the origin of the blood had been determined by the ureteral catheter, and if such a patient is operated on, several factors should be borne in mind

1. That often to gross inspection a kidney may appear normal and on histologic study it may show marked inflammatory or degenerative changes

2. That if the kidney appears normal and the microscopic sections do not show pathologic changes, perhaps we have overlooked a lesion in the renal pelvis

Hence it might be advisable at times to perform a pyelotomy. The existence of lesions of the renal pelvis, in as much as they are usually devoid of subjective symptoms, may escape detection and be recorded as cases of essential hæmaturia. Lesions of the renal pelvis associated with hæmaturia have been well described by Guibe (29), Karaffo-Korbutt (36), McGowan (48), Peterkin (54), Pilcher (55), Zimmer (72), and Von Frisch (22)

Zimmer speaks very strongly for vessel changes in the pyramids in those cases in which the parenchyma of the kidney is normal, and he also calls attention to a publication of Guthrie on this subject as far back as 1902.

In his two reported cases he is inclined to look upon them as cases of essential hæma-

turia, although he could not fulfill the dictum that before diagnosing essential hæmaturia the entire kidney must have been examined after serial sections had been made. He is inclined to believe, however, that in those cases in which the excised piece of kidney tissue does not show any nephritic changes, anomalies of the blood-vessels of the pyramids may be the cause of the bleeding. These vessel changes may be arteriosclerotic in nature, dilatation of the small vessels or angiomatosis of the papillæ

Von Frisch (22) found a pyelitis granulosa in one of his hæmaturia cases.

In some of the cases, lesions both of the pelvis and the kidney were found—Keefe (37), Haynes (32), Karaffo-Korbutt (36).

Fullerton (23) found macroscopic changes in the form of adhesions, although he believes his case to have been one of hæmorrhagic nephritis.

From the literature at my command I have collected reports of eighty-two further cases not included in my previous report (41), variously described in the literature. Of this number histologic reports were found of twenty-seven cases. In five of the twenty-seven cases there were no histologic changes. In three of these five cases—Graff (28), Warren (68), Zimmer (72)—an excised piece of kidney was examined and found normal. This does not prove them to have been cases of essential hæmaturia as by excision the pathologic process may have been missed as well as having overlooked lesions of the pelvis. In the other two cases—Steinthal (65) and Reifferscheid (58)—nephrectomy was performed in each case and the entire kidney was subjected to a histologic examination without finding any pathologic changes. "In the remaining twenty-two cases, changes of a nephritic nature were found."

Ballochs' (3) case is interesting because of an occurrence of painless hæmaturia with several pregnancies. Nephrectomy: microscopic examination showed changes of a granular kidney. The patient subsequently became pregnant again. This pregnancy was accompanied by hæmaturia which disappeared after the child was born.

Fowler's (20) second case is interesting

because of the multiplicity of the histologic changes found on microscopic examination.

### CONCLUSIONS

1. Unilateral renal hæmaturia does not always mean unilateral disease, as one may be dealing with a bilateral lesion although only one side may be bleeding at the time of examination.

2. Absence of albumin and casts in the urine does not exclude the presence of nephritic changes in the kidney.

3. Cystoscopy and ureteral catheterization must be employed in each case to determine definitely the renal origin of the blood.

4. Histologic examination of several pieces of excised tissue or preferably of the entire kidney must be made in every case before a diagnosis of essential hæmaturia can be made.

5. Cultures of catheterized specimens of urine from each kidney, to determine a possible bacterial cause for the hæmorrhage, must be made in all obscure cases.

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## SUCCESSFUL REMOVAL OF OVER ELEVEN FEET OF SMALL INTESTINE

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THE removal of over two hundred centimeters of small intestine has always aroused a peculiar interest judged by the frequent reports of successful cases. Leaving aside the pride of reporting such cases, there is a certain scientific value to carefully prepared reports of this kind, because it is of great interest to know how much intestine can be removed with safety. Furthermore it is of value to study carefully the cause of death in those cases dying of inanition, whether directly following operation or in a year or two from that date. In this connection, the following case report may prove of interest.

I, P., 20 years, referred by Dr. Harris of Tonawanda, New York. Approximately three weeks previous to operation patient was taken ill with an infected throat. He was confined to bed for several days and during this time suffered some pain in the abdomen, associated with vomiting. For a few days he improved, and intended resuming his work, but on April 5, 1912 he was taken with cramps in the abdomen which he ascribed to constipation. In the meantime his throat had practically recovered. On the 6th and 7th he had more pain, cramp-like in character but still not sufficient to confine him to the bed. On the 8th he began vomiting which continued until the time of operation, namely, the 10th of April. On the 9th there was considerable odor to the vomitus and on the 10th it was distinctly fecal. On this date he called Dr. Harris, who sent him to the Buffalo General Hospital. He had not had a bowel movement since April 7th.

When I saw the patient at the hospital it was apparent at a glance that he was an extremely sick man, with an expression not unlike the hypochondriacal facies. He had just vomited a considerable quantity of dark fecal material, thus making a tentative diagnosis of intestinal obstruction comparatively certain. The abdomen was distended tympanitic and tender. No mass was palpable, rectal examination was negative, his temperature was 99, pulse 119, leukocytes 15,000. The exact diagnosis was not quite clear, but several facts stood out prominently. There was no hernia present, no mass palpable, and no previous operative history—all, in a patient of 20 years, were pertinent factors in eliminating many of the causes of intestinal obstruction. Further, his obstruction was not particularly rapid, he having been sick almost three

weeks. Again one was almost forced to consider his present condition in some way dependent upon his original infected throat.

At the time of the operation, the connection between the abdominal condition and that of his throat was not considered, but in view of the later developments of the case, it now seems reasonable to suppose his mesenteric thrombosis was due to an infected thrombus originating from his throat. Under ether anesthesia operation was immediately performed. I found extensive gangrene of the ileum, extending within a few inches of the cæcum upward for a considerable distance. At the cæcal end the black color of the bowel faded into a purple, showing that the circulation of the lower end was only partially occluded. The mesenteric vessels were thrombosed to such an extent that even the veins were full of clots. Excision was made at the base of the mesentery, well beyond the involved area. Both ends were closed, and a lateral anastomosis was made, with suture, between ileum or jejunum and cæcum.

At the time of operation I had no idea of the extent of the removal, only when measured did I appreciate it. The mesentery was divided close to the bowel and the intestine then placed in a straight line on the floor without tension. It measured slightly over eleven feet, to be exact 336 cm.

The patient left the table in good condition and enjoyed an unusually quiet convalescence, with the exception of a hemorrhage which occurred, per rectum, on the 10th day. On the fourth day he had seven stools without catharsis, and varying from six to eight on succeeding days. For a time he was placed on a diet rich in starches and sugars, with bismuth and even opium to control diarrhea. About one month later he was given the usual house diet and much less disturbance followed. At the present time he is gaining in weight, having gained three pounds in the last week. He has one large formed stool in the morning, and usually two small fluid stools during the rest of the day.

There are several points of interest in these extensive resections, and it is quite important to report them in detail, not alone to determine how much intestine may safely be removed, but also to discover, if possible, the cause of these metabolic disturbances and to explain some of the discrepancies in the published results. Upon careful examination of literature, one is immediately impressed with the fact that many cases of resection of under 300 cm. die of inanition, and

others above that figure, even as extensive as 524 cm., have scarcely any disturbance. It would seem that the higher in the intestinal canal the resection is made, the less likely we are to encounter this trouble. It is more than possible, and I believe highly probable, that this explains certain discrepancies between different reports. In my case, the anastomosis was made at the cæcal valve and might explain the diarrhœa when more extensive resection higher up would have none.

Furthermore, I am convinced that a great discrepancy exists in the method of measurement. Every one has seen an appendix contract following its removal, so one can well imagine the contraction in intestine following its removal might amount to several inches. So those cases where the bowel was measured previous to its removal would naturally be more extensive than those measured some time after removal. Further, a bowel distended with fecal material will measure more from distention than one which is collapsed. Again, if the mesentery be divided close to the intestinal tube, the measurement will be less than if measured around the outside of the bowel with the mesentery attached.

My own particular case was measured in the worst possible way to make it appear a record case. It was measured outside of the body, without distention after the mesentery was removed, being placed without traction in a straight line on the floor. Had I realized at the time its extent, I should have measured it in each way to show the difference between methods of measurement.

In this connection, I measured the intestinal canal a few hours after death for a distance of eleven feet. After removal it measured ten feet and nine inches. When measured with the mesentery severed close to the gut and placed in a straight line on the floor, it was only ten feet and six inches. According to the accuracy with which the mesentery was removed the length varied all the way from ten feet, to ten feet nine inches.

In any event there must be some definite reason why metabolic disturbances follow the removal of 300 cm. in one case, and no

disturbance results in another instance of greater extent. I presume the total variance in length of intestine in different individuals may account for certain discrepancies, but it could scarcely account for the great difference which exists in the published results.

Physiologically fluids are absorbed from the large intestine, and so diarrhœa follows the operation of removal of the large gut. It is fair to presume, where the resection has been made lower down, that the probabilities of diarrhœa are greater. For instance, in my case the anastomosis was made at the cæcum, removing the lowest portion of the ileum, and this might account for diarrhœa, where even a greater amount removed higher in the intestinal canal would produce little or no disturbance. This fact doubtless explains certain discrepancies in the reports, but either errors or different methods of measurements explain the majority of them.

The reason these cases suffer from metabolic disturbances is fairly clear. Where the greater portion of the absorbing surface has been removed, the intestinal contents would remain in a fluid state, accounting for the diarrhœa. In considering measures for its relief when it is present, there are two ways of overcoming the difficulty. Either by placing the patient on a diet easily absorbed, or by giving a diet which would leave a large residue, making the stools more formed. There has been a good deal of work done along this line, both in dogs and in human beings, although comparatively few of the record human cases have been thoroughly studied from the chemical standpoint. It has been found in both human and animal cases that carbohydrates are much better tolerated than the fats.

My own particular case seemed to gain much better under the regular hospital diet for well patients than upon any special diet. For the first few weeks he was on a diet composed largely of starches and sugars, with a minimum of fats. While this was going on he was having from seven to ten stools a day, in spite of the fact that he was given bismuth and even opium. Under increased diet, however, he gained in weight and improved in every way physically, the stools being

No	Operator	Amount Resected, Cm	Result	Metabolic Disturbances	Remarks
1	Ghedini	372	Recovery		Strangulated hernia
2	Nieruoh	370	Recovery	Moderate	Obstruction from adhesions
3	Storp	310	Recovery	Moderate	Sarcoma of mesentery, recurrence, death
4	Steda	475	Recovery	Slight	Fatigue after exertion
5	Axhausen	475	Recovery	Moderate	Volvulus death 6 months later tuberculous
6	Friedrich	400	Recovery		Functional short-circuit
7	Pauchet	400	Recovery	Violent	Gangrene hernia
8	Mitchell	366	Recovery		
9	Werelius	375	Recovery	Slight	Abortion rupture of uterus
10	McGuire, F. R.	336	Recovery	Moderate	Mesenteric thrombosis
11	Ruggi	330	Recovery		Strangulation and adhesion 3 operations
12	Morton	322	Recovery		Myosarcoma of mesentery
13	Whitall	320	Recovery	None	Abortion Perforation of uterus
14	Zedler	318	Recovery		Hernia
15	Fuecher	316	Recovery		Incarcerated hernia
16	Barr	316	Recovery	Slight	Ovarian tumor (sac fistula short circuiting later resection of short-circuited loop
17	Ghedini	315	Recovery		Strangulated hernia Death in 3 1/2 months Mesenteric
18	Fantlao	316	Recovery	Moderate	Gangrene volvulus
19	Stachlin	304	Recovery	Slight	Strangulated hernia Recovered perfectly
20	Friedrich	300	Recovery		Septic peritonitis short-circuiting without resection
21	Gibbell	300	Recovery	Slight	Mesenteric hernia and volvulus

reduced to three or four a day. I have urged him to return to the hospital for accurate observation in order to compare the intake with the output both from the point of view of carbohydrates and nitrogen, but he is doing so well at home that he refuses to again enter the hospital, and it is almost impossible to study these cases accurately in any other way.

While I was engaged in searching the literature for cases of extensive resection, I was fortunate in reading a similar article by Dr. Flint, Professor of Surgery at Yale University. The list appended is taken directly from his table in the May number (1912) of the Johns Hopkins Bulletin. There are two changes which I have made. Case 45, reported 335 cm., should read 310, and, again, the number of cases of 200 cm. is

now becoming so great that I have only included those successful cases of 300 cm. and above.

In analysing the following cases, I find my own case the most extensive resection on record due to mesenteric thrombosis. It is the second largest resection for any cause in American literature, and is the tenth largest in the entire literature. Furthermore, when one considers the differences in the metabolic disturbances, and the probable difference in measurement, I feel quite certain this case should really be higher in the list. Mesenteric thrombosis is a most serious condition, and without resection offers absolutely no chance of recovery. One is, therefore, justified in attempting removal at all hazards, since anything short of complete extirpation means certain death.

## SOME OBSERVATIONS ON THE PROTEIN METABOLISM OF NORMAL PREGNANCY AND THE NORMAL PUERPERIUM

By JOHN R. MURLIN, Ph. D., New York City  
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**I**N February, 1911, the writer, with Mr Thorne M. Carpenter,<sup>1</sup> reported observations made at the Nutrition Laboratory in Boston on the energy metabolism of three normally pregnant women<sup>2</sup> and on both mother and child after parturition. Since it was necessary to control the diet of the mother for the purpose of securing a uniform effect of the food on the energy metabolism, it seemed a good opportunity to collect a series of urines from normal subjects in the pregnant condition. No analyses as complete as those here reported have yet been made on such urines. Those of Edgar<sup>3</sup> and those of Ewing and Wolf<sup>4</sup> come nearest, but they covered only the nitrogen fractions; only two or three urines as a rule were collected from each case, and there was no attempt to maintain a constant diet or to estimate the amount of nitrogen in the food.

Throughout the time of these observations, except for two or three days immediately following parturition, the patients were kept on diets<sup>5</sup> which were fairly uniform as regards the nitrogen content (see tables beyond) and the energy value, but which, nevertheless, permitted of considerable variation. The amount prescribed was intentionally such as to constitute a rather restricted diet, but was sufficient except in Case 3 to maintain the body weight. This woman lost five pounds the five weeks she was confined to the hospital previous to parturition. She was the only patient who complained of the diet, either because of the quantity or

quality of food allowed. However, as the records show that on most of the days she ate approximately the amount calculated for her, the diet could not have been distasteful. The chief objection was due to the absence of meat, a condition which was necessary in order to render the diet creatin-free (For further details regarding weight and general condition of the patients, see the charts in the former paper.)

Every day upon which urine was collected, the exact amount of food eaten was recorded by the nurse in charge. The amounts prescribed were weighed on the plate by means of a torsion balance sensitive to half a gram, the amounts uneaten being weighed back and deducted.<sup>6</sup>

The urines were preserved with thymol in chloroform, 10 cc of a 10 per cent solution being placed in each bottle at the laboratory before the bottle was sent to the hospital. When the urines arrived at the Nutrition Laboratory, they were measured, made up to uniform volume, and rebottled. Albumin was recorded only once (Case 2), and then was not abundant.

## METHODS OF ANALYSIS

Ammonia was determined by the Folin method in the great majority of the urines within a day or two of their collection, and wherever signs of decomposition appeared, the results have been discarded. The determinations of creatinin (Folin), creatin (Benedict and Meyer's conversion by autoclave) and of total nitrogen (Kjeldahl), in the order named, were made as rapidly as was physically possible. The urines were then stored in a large refrigerator for three months before the urea and sulphur analyses were completed. In one series (Case 3) the "formol-titrating" fraction was determined by the method of Henriques and

<sup>1</sup> Carpenter and Murlin. *Archiv. Internat. Med.* 1911, vii, p. 183.

<sup>2</sup> The patients were selected by Dr. John T. Williams of Boston from lists very kindly furnished from the outpatient department of the McLean Lying In Hospital through the courtesy of Dr. Charles M. Green. All were cared for in confinement and through puerperium by Dr. Williams to whom the writer is under great obligations for his very willing and efficient services. Case 1 was received at the New England Dispensary Hospital only one week previous to delivery. Case 2 was received a little over three weeks previous and Case 3 five weeks previous. All the patients made uneventful recoveries (see temperature charts in the previous paper), and were discharged about the usual time for normal cases.

<sup>3</sup> Edgar, N. Y. M. J. 1906, lxxix, p. 897.

<sup>4</sup> Ewing and Wolf. *Am. J. Obst.*, N. Y., 1907, iv, p. 289.

<sup>5</sup> Samples of these daily diets were given in the former paper.

<sup>6</sup> Both the regulation of diets and for the most part, the collection of urines were faithfully carried out. For the success of these observations in this particular the writer is indebted to Miss Zella MacLaughlin the head nurse of the hospital.



Sorensen,<sup>1</sup> now known as their "old method." That is, the ammonia nitrogen was subtracted from the total fraction titrating with formalin. In urines which do not contain an excess of ammonia this method is almost as accurate as their "new method," in which the ammonia is removed before the titration with formalin.

For the total sulphur<sup>2</sup> the sodium-peroxide method of Osborne, following the procedure of Folin, was used; and for the inorganic-sulphate and ethereal-sulphate fractions, the methods of Folin

#### DIFFICULTY OF PRESERVING POSTPARTUM URINES

One result of these observations should be mentioned at this point, namely, nearly all the urines in the puerperium of two out of the three cases showed a large amount of ammonia. Since there was no sign of an acidosis of any kind, the excess of ammonia was evidently due to decomposition. But since these particular urines were collected and preserved with even more care than those of the antepartum period, the decomposition was for a time very puzzling. This paper has, in fact, been delayed until the matter could be cleared up. In another paper published recently by Dr H C Bailey and the writer<sup>3</sup> the view has been advanced that ammoniacal decomposition may take place in the bladder after the use of the catheter, even though the usual aseptic precautions be observed. The pertinent point in this connection is that the two patients (both primiparae) whose urines showed decomposition were unable to void the urine spontaneously, and the catheter was used for several days following delivery,<sup>4</sup> but the one whose urine

showed no decomposition (multipara), voided the urine spontaneously after careful cleansing of the parts and light packing of the vagina to prevent admixture of blood.

#### COMPARISON OF AVERAGE COMPOSITION OF THE URINE OF LATE PREGNANCY WITH THAT OF THE URINE OF THE PUERPERIUM

In Table I are summarized the average compositions of the urines from all three cases before delivery and after. For reasons which will be apparent later, the antepartum period in Cases 2 and 3 has been divided into two subperiods of ten days each. With Case 1, the antepartum period of observation was only five days, and one of the urines was not properly preserved, thus leaving only four days. With Case 1, every drop of urine was collected on the day of parturition and following, but the fifth day postpartum showed the first high ammonia. From this time on, the ammonia and the urea figures are excluded; but the combined urea-plus-ammonia figures are given, in the belief, confirmed by recent determination of total nitrogens, that no ammonia had escaped from the bottle. In the postpartum period of Case 3, the urine was not saved until the fifth day, and the ammonia and urea figures are for this day only, because the decomposition appeared on the sixth day. Only one urine, the first after delivery, with Case 2 was lost entire, but on several other days a small quantity was voided with the faeces and could not be separated. The amount lost was too small to affect the percentage results.

#### TOTAL NITROGEN

With the exception of Case 3, the total amount of nitrogen in the urine was almost exactly the same in the antepartum and postpartum periods. Case 1 was probably not retaining nitrogen in the few days that preceded delivery. This is not unusual. A minus nitrogen balance at this time has been observed by Zacharjewsky,<sup>5</sup> Slemmons,<sup>6</sup> Hahl,<sup>7</sup> Bar and Daunay,<sup>8</sup> and Hoffstrom.<sup>9</sup> The

<sup>1</sup> Henriques and Sorensen. *Ztschr f physiol Chem* 1900 ix p 1. Idem 1910 lxxv p 120.

<sup>2</sup> All of the sulphur analyses were done under the direction of the writer by Mr Ernest A Congdon, a very careful analyst.

<sup>3</sup> Morfin and Bailey. *J Am M Ass* 1912 lxx, p 1522.

<sup>4</sup> The writer wishes especially to exempt Dr Williams under whose direction the catheter was used, as well as the nurse who used it from any responsibility for this unfavorable result. The asepsis was no doubt as complete as possible. As pointed out in the paper with Dr Bailey the catheter may be perfectly sterile, the hands that use it may be perfectly sterile also, and the external parts may be perfectly cleaned, but if the catheter push ahead of it a plug of mucus containing the Micrococcus ureae, and especially if the urine contain a trace of albumin, there is every possibility that the urine retained for several hours may undergo decomposition in the bladder without producing a cystitis. Further, if milk is the chief constituent of the diet at this time the urine is less acid and the chances of decomposition are even greater than on a meat diet.

<sup>5</sup> Zacharjewsky. *Ztschr f Biol*, 1904, xxx p 368.

<sup>6</sup> Slemmons. *Johns Hopkins Hosp Rep* 1905, xv, p 121.

<sup>7</sup> Hahl. *Archiv f Gynak* 1905 lxxv, p 31.

<sup>8</sup> Bar and Daunay. *Archiv de Physiologie et de Pathologie générale* 1905 vu p 332.

<sup>9</sup> Hoffstrom. *Skand Archiv f Physiologie*, 1910 xxix p 326.

reason is probably to be found in the failing appetite, especially in primiparae, and possibly in catabolic changes which result in the onset of labor. Cases 2 and 3 were undoubtedly retaining nitrogen in both periods previous to delivery, more in the earlier period with Case 2 and more in the later period with Case 3. The significance of these differences for the percentage distribution of the nitrogen will be seen presently.

Since the amount of food taken by these patients just after delivery was very small (see the paper by Carpenter and Murlin, loc. cit.), there is no doubt that very much more of the nitrogen appearing in the urine at this time had its source in the body itself. All modern authorities agree that involution of the uterus is accomplished by a process of autolysis, and that a considerable portion of the products escape by way of the kidney, some probably being used in the formation of milk and a trace possibly making exit by way of the intestine. Authorities differ, however, as to the time when the autolytic products make their appearance in the urine. Slemons (loc. cit.) states that the nitrogen curve tends to reach a maximum on the third day postpartum, while the tables given by Zacharjewsky and Hahl show that the maximum comes somewhat later in their cases, and that the augmented excretion of nitrogen continues to the end of the second week. It is necessary, in order to determine accurately the appearance and disappearance of uterine products, to have the patient throughout on a constant diet. Longridge<sup>1</sup> who seems to have taken more pains to fulfill this condition than other observers, noted superimposed on the gradual rise, which one would naturally expect following parturition, a secondary rise of about three grams nitrogen occurring quite suddenly at about the fifth day postpartum. Longridge accounts for this secondary rise by supposing that the circulation is not fully re-established following the rigid contraction of the uterus at the end of labor, and owing to kinking of the vessels, until about this time, consequently that autolytic products formed previously cannot be carried away as rapidly as they are produced.

Longridge quotes Dakin's "Manual of Midwifery" to the effect that, on the evidence of frozen sections, the uterus does not diminish much in actual mass the first few days.

In Case 1, the nitrogen in the urine showed a sudden increase from 9.18 gms. to 12.03 gms. on the seventh day postpartum, and Case 3 a similar increase from 7.63 gms. on the fifth day to 9.54 gms. on the sixth day (See Tables II and IV). Since there was no corresponding increase in the food in either case at this time, it is probable that the rise corresponds to the one Longridge describes. The writer has been unable to find any statement in the literature to support Longridge's view as to the return of the circulation, but in lieu of this explanation it is quite conceivable that the autolysis gains headway during the first few days and reaches a stage where diffusible products are set free in large quantity only at the end of the first week. The amount of nitrogen in the urine alone continued as high or higher than the nitrogen in the food in both these cases throughout the puerperium. In Case 2 it was lower at times, even when no urine was lost, before the end of these observations.

#### AMMONIA NITROGEN

It is well known that the amount of ammonia in the urine depends on two factors: the nature of the ash furnished by the food and the amount of acid formed by the body. Sherman and Gettler<sup>2</sup> have shown recently that a change from potatoes to rice in the diet may be responsible for a noticeable increase in the ammonia excreted by the kidney, because rice furnishes more acid than potatoes. And Janney<sup>3</sup> has been able to drive ammonia out of the urine almost completely by administration of sodium carbonate with the food.

The table shows a considerably smaller amount of ammonia nitrogen in the postpartum urines than in those of the antepartum period.<sup>4</sup> No doubt this is partly explained by the greater proportion of milk in the diet for the first few days of the puerperium, since

<sup>1</sup> Sherman and Gettler *Am J Biol Chem*, 1912, xi, p. 323.

<sup>2</sup> Janney *Ztschr f. physiol Chem*, 1912, lxxvii, p. 99.

<sup>3</sup> This is shown also by the tables of Van Hoogenhuyze and ten Doeschate (loc. cit.)

<sup>4</sup> J. Obst & Gynec, 1908, xxi, p. 420

milk furnishes an ash that contains more bases than do most of the other foods given (see table compiled by Sherman and Gettler). However, all the patients returned to the same diet which was given before confinement not later than the fifth day and yet the urines of Case 2 (the only ones not decomposed after this time) continued to show low ammonias even when the total nitrogen was at the highest. The explanation must be sought in the nature of the ash set free by the process of autolysis going on in the uterus.

#### UREA NITROGEN

This fraction is obtained by the Folin method by subtracting the ammonia nitrogen from the "total amid" nitrogen which all such methods give, consequently it could only be determined in urines which had not changed after having passed the kidney. For Cases 1 and 3 the number of such urines was too small to make the average composition in the postpartum period worth much for comparison with the antepartum period. Hence we shall call attention to the comparison for the urea nitrogen only in Case 2. Here it is seen that the absolute amount of urea in the two periods is very nearly the same, 5.68 gms (mean of the two subperiods) before delivery and 5.77 gms after. These amounts also bear very nearly the same relation to the total nitrogen in the two periods, 74.7 per cent before delivery and 75.2 per cent after.

#### UREA-PLUS-AMMONIA FRACTION

Adding together the urea and ammonia nitrogens in the antepartum and postpartum periods of Case 2 we get 6.12 grams in the former and 6.10 grams in the latter, or 80.3 per cent of the total nitrogen on the one hand and 79.5 per cent on the other. For Cases 1 and 3 the absolute amounts are not so nearly alike in the two periods, but in relation to the total nitrogen they agree as closely as for Case 2; thus, Case 1, antepartum 86.4 per cent, postpartum 86.7 per cent; Case 3, antepartum 80.7 per cent, postpartum 81 per cent.

This fraction represents in the protein metabolism all the nitrogen which has been split off from the amino acids delivered to the circulation either from the intestine or

from the tissues; hence, if there should be any interference with the processes by which amino nitrogen is split off and converted into ammonia or to urea, we should expect to find this fraction low in proportion to the total nitrogen. Ewing and Wolf (loc. cit.), recognizing this possibility, argued that low urea plus ammonia nitrogen, which they found even in normal pregnancy, indicates an impairment of the metabolic functions of the liver. Van Hoogenhuyze and ten Doeschate<sup>1</sup> in summarizing results on four normal cases, state that in three of the four they find "about the normal" figures (for non-pregnant persons). One of the three, however, was only in the fourth month, and may therefore be excluded from this comparison; while of the others, one (XIV) shows a combined percentage for both urea and ammonia nitrogen which is certainly somewhat below the standard from Folin's work accepted by them. What this standard is depends, as Folin has abundantly proved, on the total amount of nitrogen in the urine, and this in turn depends, among other things, upon the amount being retained for growth or replenishment. It is impossible to set an absolute standard for all persons and to say that anything below this percentage represents a departure from normal, without knowing all the conditions. For this reason it cannot be said of the percentages reported above for the three cases in the present series that they would not have been just as low under the same dietary regulations if the subjects had not been pregnant. Comparison with Folin's percentages for urines which contained approximately the same quantity of total nitrogen is of little profit because of the very unusual dietary regulations which prevailed in his experiments.

Nevertheless such a comparison shows that the figures given above in the antepartum division of Table I, like those of Ewing and Wolf, and all but one case of Van Hoogenhuyze and ten Doeschate, are slightly lower than average percentages selected for the same total nitrogen from Folin's tables.

In a pregnant dog<sup>2</sup> it has been found that

<sup>1</sup>Ann. de Gynec., 1911, 2d Ser., viii, pp. 17 and 97.

<sup>2</sup>Murch. Am. J. of Physiol., 1912, xxviii, p. 422.

the combined urea-plus-ammonia fraction becomes relatively lower as more and more nitrogen is retained for the growth of the developing fetuses, a fact which affords an entirely different explanation of the altered partition from that given by Ewing and Wolf. It means simply that nitrogen which is ordinarily excreted in the urine as urea or ammonia is the kind of nitrogen which is especially needed by the fetus for growth. The effect of withdrawing the bodies which furnish this nitrogen from the maternal circulation in large quantity would be to make the urea-plus-ammonia fraction in the urine both relatively and absolutely less than in the non-pregnant condition. But if the quantity withdrawn is small in comparison with the total intake of nitrogen, the effect on the percentages might not be appreciable. In one of the cases reported by Van Hoogenhuyze and ten Doeschate, the total amount of nitrogen in the urine on most of the days was over twenty grams; hence the amount diverted for the fetus each day scarcely made an appreciable change in the percentage composition of the urine. In the dog, the weight of the offspring at birth is larger in comparison with the weight of the mother than is the case with woman, consequently in the last weeks of pregnancy more nitrogen relatively is diverted, and the percentage of urea-and-ammonia nitrogen falls.

This fall, however, might not have been recognized in the dogs if the percentages had not been followed throughout the pregnancy, and it was seen that a relationship existed between them and the amount of nitrogen retained in the different weeks. It could scarcely be recognized at all in the pregnant woman unless (1) the food were constant or nearly so, and (2) the analyses were continued for a period of at least two weeks.

Both these conditions have been fulfilled in Cases 2 and 3 of this series. The antepartum period is divided in the table into two subperiods of ten days each, and, as might be expected, the one in each case in which the greater retention of nitrogen *probably*<sup>1</sup> took

place is the one in which the percentage of urea-plus-ammonia is least.

#### "FORMOL-TITRATING" FRACTION

This was determined for only one case (Case 3). In absolute amount it is strikingly similar in each of the three periods — two antepartum and one postpartum; but because the urea-plus ammonia fraction is relatively lower in the later antepartum period than in the earlier period, the percentage of the "formol-titrating" fraction is higher. This suggests the behavior of an endogenous fraction which tends to remain constant in contrast with an exogenous fraction which varies with the amount of nitrogen in the food,<sup>2</sup> etc. If we may infer from this that the bodies (mostly mono-amino acids but possibly some polypeptides as well) which react with formalin have their origin in the body, it is a singular and important fact that they do not materially increase in amount during the involution period. The autolytic products, therefore, for the most part suffer conversion to urea before their excretion by the kidney.

#### CREATININ

In both absolute and relative terms the creatinin is present in greater quantity before parturition than after in Cases 1 and 2. Case 3 does not show the difference, because the analyses for this substance were made on only two of the postpartum days. The higher absolute quantity in the antepartum urines is doubtless due in part to the ingestion of more creatinin in the food<sup>3</sup> in this period. Patient 3, however, was on a creatin and creatinin-free diet throughout and ate slightly less protein (cf. nitrogen figures) in the later ten-day period than in the earlier. While the amount of creatinin for this patient on the fifth and sixth postpartum days was the same as in this later period, it was 80

of Hahl and Hofferstrom there is a noticeable increase in the amount of nitrogen in the feces in the last few days of pregnancy, the absorption probably being interfered with by the intra-abdominal pressure. The differences observed, however, if applied to the present cases, would only accentuate the difference in retention in favor of the earlier period of Case 2 and would not offset the difference in favor of the later period of Case 3.

<sup>1</sup> Cf. Folin. *Am. J. of Physiol.*, 1905, xiii, p. 66.

<sup>2</sup> Both patients 2 and 3 ate meat up to the day of delivery, but were kept on a milk diet until the fifth day thereafter. Since the meat was thoroughly cooked it probably contained little creatin. Cf. Mellanby, *J. of Physiol.*, 1908, xxxvi, p. 447.

<sup>3</sup> It is necessary to say "probably" because (1) the nitrogen in the food was not determined directly but was only estimated from Atwater and Bryant's average figures (Bulletin 28, Dept. of Agriculture Publications), and (2) because the feces were not analyzed. In the experiments

milk furnishes an ash that contains more bases than do most of the other foods given (see table compiled by Sherman and Gettler). However, all the patients returned to the same diet which was given before confinement not later than the fifth day and yet the urines of Case 2 (the only ones not decomposed after this time) continued to show low ammonias even when the total nitrogen was at the highest. The explanation must be sought in the nature of the ash set free by the process of autolysis going on in the uterus.

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<sup>2</sup> *Medica. Am. J. of Physiol.*, 1911, xxvii, p. 421.

TABLE III CASE 2—(MRS E W) MULTIPARA

Date, 1909	N in Food (gitt. unaltered)	NITROGEN FRACTIONS IN URINE—GRAVS							PER CENT OF TOTAL N					SULFUR FRACTIONS				PER CENT OF TOTALS			
		Total N	NH <sub>4</sub> N	Urea N	Urea + NH <sub>4</sub> N	Crea trans N	Crea trans N	Crea tin N	NH <sub>4</sub>	Urea	Urea + NH <sub>4</sub>	C <sub>1</sub>	C <sub>2</sub>	Total Accounted for	Total S	Inorg. Sulph S	Ether. Sulph S	Neutral S	Inorg	Ether	Neutr
May 22-23	11.0	8.60	0.28	5.47	6.25	0.37	0.07	0.11	9.1	63.5	72.6	4.3	1.3	78.2	0.67	0.55	0.05	0.07	82.2	7.4	10.4
May 23-24	8.8	6.04	0.38	4.25	4.66	0.74	0.07	0.11	5.3	70.9	77.2	4.0	1.3	82.4	0.46	0.33	0.04	0.10	59.6	3.7	21.7
May 24-25	9.0	7.94	0.43	5.76	6.10	0.31	0.11	0.11	5.4	72.5	77.9	3.9	1.4	83.2	0.50	0.45	0.06	0.08	76.3	10.2	13.5
May 25-26	8.5	6.07	0.41	5.16	5.57	0.10	0.10	0.10	5.0	74.0	79.0	4.3	1.4	85.5	0.52	0.39	0.04	0.00	75.0	7.7	17.3
May 26-27	8.7	7.31	0.43	5.50	6.02	0.21	0.08	0.10	5.0	76.5	81.4	2.8	1.1	86.3	0.56	0.43	0.05	0.08	76.8	9.0	14.3
May 27-28	8.9	8.58	0.43	6.30	6.87	0.35	0.12	0.12	5.5	72.8	78.3	4.0	1.4	83.7	0.67	0.53	0.05	0.09	70.1	7.5	13.4
May 28-29	8.7	7.83	0.38	5.87	6.25	0.30	0.17	0.17	4.8	74.9	79.7	3.8	1.4	84.9	0.61	0.48	0.04	0.09	78.7	6.6	14.7
May 29-30	8.7	6.38	0.35	4.53	4.88	0.27	0.00	0.00	5.5	71.1	76.6	4.2	1.4	83.2	0.52	0.40	0.04	0.08	77.0	7.7	15.3
May 30-31	8.7	7.68	0.45	5.12	5.57	0.31	0.13	0.13	5.9	66.7	72.6	4.0	1.7	78.5	0.58	0.45	0.05	0.08	77.6	8.6	13.8
May 31-June 1	8.8	8.73	0.45	6.37	6.82	0.34	0.07	0.11	5.2	72.9	78.1	3.9	0.8	83.8	0.65	0.50	0.06	0.09	77.0	9.2	13.8
Average 22d Period	8.65	7.35	0.45	5.45	5.90	0.30	0.10	0.10	5.05	72.6	77.9	3.9	1.3	79.75	0.58	0.45	0.04	0.085	76.9	8.25	14.8
June 1-2	8.7	8.73	0.47	6.45	6.93	0.30	0.14	0.14	5.4	74.0	79.4	3.4	1.6	84.4	0.64	0.48	0.05	0.11	75.0	7.8	12.2
June 2-3	8.7	7.71	0.46	5.79	6.25	0.31	0.13	0.13	6.0	75.1	81.1	4.0	1.7	86.8	0.65	0.47	0.06	0.10	74.6	9.5	15.9
June 3-4	8.1	7.60	0.40	5.06	5.06	0.31	0.00	0.00	5.3	73.3	78.5	4.1	1.1	83.7	0.61	0.41	0.07	0.10	72.1	11.5	16.4
June 4-5	8.9	7.40	0.41	5.49	5.90	0.31	0.02	0.02	5.5	74.2	79.7	4.3	0.3	84.2	0.64	0.50	0.05	0.10	72.3	9.2	18.5
June 5-6	8.5	9.08	0.52	6.86	7.38	0.25	0.08	0.08	5.8	76.3	82.1	4.2			0.65	0.54	0.06	0.06	81.7	9.1	0.2
June 6-7	8.4	7.63	0.42	5.83	6.25	0.33	0.12	0.12	5.5	76.4	81.9	3.9			0.61	0.44	0.06	0.11	75.2	9.8	18.0
June 7-8	8.7	6.64	0.35	5.16	5.51	0.11	0.03	0.03	6.6	74.5	81.1	3.2			0.48	0.38	0.03	0.07	79.2	6.9	14.6
June 8-9	8.4	8.31	0.58	6.18	7.16	0.11	0.03	0.03	6.6	74.5	81.1	3.2			0.48	0.38	0.03	0.07	79.2	6.9	14.6
June 9-10	8.6	7.09	0.43	6.10	6.53	0.11	0.03	0.03	6.1	85.1	93.2				0.54	0.41	0.05	0.08	76.0	0.2	44.8
June 10-11	8.9	0.43	0.40	5.45	5.68				6.2	81.5	87.7				0.46	0.35	0.04	0.07	76.1	8.7	15.2
Average 22d Period	8.65	7.71	0.44	5.01	6.15	0.31	0.09	0.09	5.8	76.0	82.7	3.9	0.9	84.7	0.566	0.44	0.05	0.09	76.2	8.7	15.4
June 11-12	8.7	5.03	0.44	3.57	3.86				5.8	71.0	76.8				0.33	0.25	0.03	0.05	75.8	9.1	15.1
June 12-13	8.4	8.11	0.45	6.10	6.25	0.30	0.12	0.12	5.5	76.5	82.0	2.5	3.9	88.4	0.53	0.40	0.04	0.09	75.5	7.5	17.0
June 13-14	7.6	4.08	0.23	3.16	3.69	0.14	0.23	0.23	4.6	69.5	74.1	2.8	4.6	81.5	0.35	0.25	0.03	0.07	71.4	9.4	18.0
June 14-15	7.6	7.37	0.26	3.14	3.40	0.18	0.27	0.27	3.5	69.7	73.2	2.4	3.7	79.3	0.43	0.28	0.05	0.10	71.4	9.4	18.0
June 15-16	7.8	6.62	0.34	4.77	5.11	0.18	0.21	0.21	3.1	72.1	77.3	2.7	3.2	83.1	0.53	0.40	0.04	0.09	75.5	7.5	17.0
June 16-17	8.5	7.40	0.30	5.05	5.46	0.17	0.24	0.24	2.6	76.4	80.6	2.3	3.8	86.1	0.53	0.44	0.04	0.09	84.6	7.7	7.7
June 17-18	7.9	7.76	0.31	6.11	6.42	0.12	0.11	0.11	4.0	76.7	82.7	1.5	4.0	88.2	0.59	0.46	0.03	0.10	78.0	5.1	10.9
June 18-19	8.4	10.15	0.44	6.94	7.38	0.15	0.36	0.36	4.3	68.3	73.6	1.5	3.5	77.0	0.73	0.57	0.05	0.12	78.2	6.8	15.2
June 19-20	8.7	7.83	0.31	6.42	6.82	0.15	0.27	0.27	4.0	78.0	82.0	1.9	3.4	87.3	0.59	0.47	0.04	0.08	79.6	6.8	13.6
June 20-21	8.8	5.36	0.20	4.34	4.54	0.11	0.18	0.18	3.7	81.0	84.7	2.1	3.4	90.2	0.41	0.33	0.03	0.06	80.5	4.9	14.6
June 21-22	8.7	10.56	0.37	8.32	8.69	0.26	0.25	0.25	3.5	78.8	83.3	2.5	2.4	87.2	0.58	0.45	0.07	0.08	80.7	9.0	10.3
June 22-23	8.4	8.99	0.37	6.45	6.82	0.19	0.27	0.27	4.5	78.8	83.3	2.3	3.3	88.9	0.60	0.53	0.05	0.11	76.8	7.3	15.9
June 23-24	7.8	7.66	0.33	5.77	6.10	0.17	0.26	0.26	4.3	75.2	79.5	2.2	3.6	85.2	0.57	0.44	0.05	0.09	77.6	7.3	15.2
Parturition Average	7.8	7.66	0.33	5.77	6.10	0.17	0.26	0.26	4.3	75.2	79.5	2.2	3.6	85.2	0.57	0.44	0.05	0.09	77.6	7.3	15.2

\* Day of parturition not included

† Parturition (child born at 2:00 a. m.)

‡ Small quantity of urine lost with feces

§ Urine from 7 a. m. to 11 a. m. (18 hours)

TABLE I. SUMMARY OF ANTEPARTUM AND POSTPARTUM URINES

Case Number of Days Average	N in food (esti- mated)	NITROGEN IN URINE—GRAMS				PER CENT OF TOTAL NITROGEN				SOLUBLE IN URINE—GRAMS				PER CENT OF TOTAL S		N:S Ratio					
		Total N	NH <sub>3</sub> N	Urea N	Urea + NH <sub>3</sub> N	Crea- tin N	Crea- tin in N	Urea NH <sub>3</sub>	Urea + NH <sub>3</sub> N	Crea- tin	Total S	Isosol- S	Ether Solub- S	Neutr S	Isosol- S		Ether- tra				
ANTEPARTUM																					
1 4 days	0.8	9.4	0.66	7.69	8.15	0.45	0.07	7.0	7.0	4.66	4	0.7	0.19	0.68	0.53	0.03	0.07	84.5	4.7	10.8	13.8
2 1st Per. 10 days	0.06	7.56	0.45	5.00	0.50	0.10	0.07	5.0	5.0	77.0	1	0.7	2.7	0.58	0.45	0.04	0.09	70.0	8.2	14.0	13.1
3 2nd Per. 10 days	0.05	7.78	0.44	5.31	0.31	0.07	0.07	5.8	5.8	82.7	3	0.6	2.7	0.53	0.43	0.05	0.09	70.7	8.7	15.0	13.7
4 1st Per. 10 days	0.55	7.03	0.46	5.50	0.50	0.17	0.20	6.0	6.0	52.0	2	0.4	0.8	0.56	0.42	0.04	0.07	73.0	12.7	15.0	13.5
5 2nd Per. 10 days	0.12	8.12	0.30	4.07	4.37	0.18	0.23	5.3	7.5	78.9	3	0.4	0.8	0.56	0.42	0.04	0.07	73.7	12.1	15.0	13.5
POSTPARTUM																					
1 15 days	6.6	0.30	0.51	7.31	8.37	0.38	0.12	6.6	82.3	65.7	3	1.3	0.6	0.68	0.52	0.04	0.08	83.1	5.6	10.3	14.7
2 15 days	7.8	0.66	0.33	5.77	6.10	0.17	0.20	4.3	7.5	79.5	3	3.0	8.5	0.53	0.44	0.05	0.09	77.6	7.3	15.2	13.4
3 8 days	8.5	0.28	0.22	5.86	6.47	0.20	0.25	6.0	76.0	81.0	3	3.3	0.3	0.69	0.55	0.05	0.09	79.4	7.5	13.1	13.3

1 Average of first four days only      2 Fifth day only      3 Fifth and sixth days only

TABLE II CASE 1—(MRS A II) PRIMIPARA

Date, 1909	N in food in feed (mated)	NITROGEN FRACTIONS IN URINE—GRAMS					PERCENTAGE OF TOTAL NITROGEN					Percent N ac- counted for	ALPHABETIC FRACTIONS GRAMS				PERCENT OF TOTAL S		
		Total N	NH <sub>3</sub> N	Urea N	Urea + NH <sub>3</sub> N	Creatin N	Urea	NH <sub>3</sub>	Urea + NH <sub>3</sub>	C <sub>1</sub>	C <sub>2</sub>		Total S	Inorg- sulph- S	Liber- sulph- S	Neutral S	Inorg	Ether	Neutr
May 20-21	12.4	8.68	0.18	7.15	0.03	0.03	6.7	82.4	80.1	4.4	0.6	0.12	0.63	0.54	0.03	0.07	88.7	3.2	11.1
May 21-22	10.8	0.75	0.79	7.43	0.37	0.06	7.1	76.7	81.8	3.6	0.6	0.52	0.63	0.37	0.03	0.03	85.8	4.4	11.8
May 22-23	8.4	10.50	0.18	0.70	0.45	0.06	6.8	80.6	87.4	5.8	0.6	0.18	0.70	0.62	0.10	0.10	81.0	0.4	12.6
May 24-25	8.4	8.76	0.64	0.80	0.67	0.12	7.3	77.6	81.0	7.6	1.4	0.10	0.69	0.55	0.03	0.04	87.3	4.3	7.9
Antagonism Average	9.8	9.44	0.68	7.49	0.37	0.07	7.0	79.4	80.3	4.3	0.7	0.19	0.68	0.52	0.03	0.07	84.5	4.7	10.8
May 16-21	0.8	6.91	0.19	5.01	0.17	0.10	3.6	25.0	90.6	5.1	2.7	0.1	0.33	0.47	0.06	0.06	70.1	10.1	10.2
May 22-28	2.7	8.10	0.36	7.10	0.13	0.10	8.7	83.0	87.7	4.0	3.4	0.4	0.33	0.44	0.03	0.03	83.0	3.8	12.2
May 29-30	4.3	8.88	0.42	7.16	0.14	0.10	8.5	87.7	91.8	3.8	2.8	0.7	0.35	0.40	0.03	0.03	83.7	3.4	13.0
May 30-31	3.4	8.86	0.75	0.63	0.16	0.10	8.5	81.0	88.3	3.8	1.8	0.2	0.36	0.40	0.03	0.03	82.1	3.0	13.4
May 31-June 1	3.8	8.86	0.50	7.85	0.18	0.10	8.5	81.0	88.3	3.6	1.0	0.1	0.37	0.47	0.04	0.04	80.2	3.7	14.7
June 1-2	7.7	0.18	7.07	0.16	0.16	0.16	3.2	92.6	92.6	3.8	0.6	0.2	0.46	0.39	0.03	0.03	74.9	4.8	10.6
June 2-3	6.3	12.03	0.16	10.61	0.18	0.10	8.4	92.6	92.6	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5
June 3-4	8.2	10.50	0.1	10.61	0.18	0.10	8.4	92.6	92.6	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5
June 4-5	8.2	10.70	0.42	9.60	0.11	0.09	9.5	90.0	90.0	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5
June 5-6	8.2	10.70	0.42	9.60	0.11	0.09	9.5	90.0	90.0	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5
June 6-7	8.2	10.70	0.42	9.60	0.11	0.09	9.5	90.0	90.0	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5
June 7-8	8.2	10.70	0.42	9.60	0.11	0.09	9.5	90.0	90.0	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5
June 8-9	8.2	10.70	0.42	9.60	0.11	0.09	9.5	90.0	90.0	3.1	1.6	0.1	0.46	0.39	0.03	0.03	84.9	7.6	7.5</

Parturition (child born at 149 gm) \* This average does not include days of parturition.

milligrams less (average) in the earlier ten-day period, when more protein food was being taken. This would seem to indicate that there is something characteristic about the appearance of more creatinin in late pregnancy. The same phenomenon was noted in two out of four pregnancies in the dog. Van Hoogenhuyze and ten Doeschate failed to observe it in their normal pregnancies, probably because in only one case out of seven in which this fraction was determined did they continue their observations later than one month previous to confinement. As we shall see presently, they think they have found in the excretion of creatin during pregnancy evidence of a distinct hepatic inefficiency, but they do not appear to realize that their theory really demands a decrease in the amount of creatinin excreted, and this their tables do not clearly show.

On no theory of hepatic inefficiency can an absolute increase in creatinin be explained. Two other possibilities suggest themselves. (1) that the creatinin excretion is roughly proportional to the mass of uterine muscle just as it is known to be for the mass of skeletal muscle,<sup>1</sup> and that the increase in mass of the uterine wall in the last weeks of pregnancy is responsible, or, (2) that creatin is formed in the foetus late in pregnancy as it is in the infant,<sup>2</sup> and is excreted through the maternal organs. Rose<sup>3</sup> has analyzed the muscles of a new-born infant and found .07 per cent of creatin. If this substance is the mother substance of creatinin, it would seem that some creatinin should be produced before birth.

#### CREATIN

The behavior of this fraction before and after parturition is just the reverse of that of creatinin, namely, a greater quantity, in both absolute and relative terms, after parturition than before. The presence of creatin in large quantity in a postpartum urine was first reported for the woman by Shaffer (loc. cit.) in October, 1908, and by the writer<sup>4</sup>

for the dog in December of the same year. Shaffer gave the correct interpretation of its presence as due to the involution of uterine muscle, and the writer noted that it reached its maximum for the dog on the fifth day postpartum. More recently the writer<sup>5</sup> has called attention to the fact that the creatin apparently is eliminated earlier than those autolytic products which (present in large quantity relatively in the dog) are excreted as constituents of the undetermined nitrogen. From Tables II and III it may be seen that the creatin excretion in these observations presents two maxima, one on the second or third day postpartum and the other on the eighth day. The first may perhaps be due simply to a squeezing out of extractives while the uterus is rigidly contracted, and the second to the liberation of creatin by a true disintegration of the muscle tissue. Creatin is not to be regarded as a true product of autolysis, since it exists preformed in the muscle.

Why does creatin appear in the antepartum urines? Since the publication of Folin's work in 1905, it has been generally believed that creatin is not a normal constituent of adult urines unless creatin is being ingested in the food. In other words, when present it is regarded as a sign of undernutrition or of actual disintegration of muscular tissue. Van Hoogenhuyze and ten Doeschate (loc. cit.) report its occurrence in a series of normally pregnant subjects on creatin-free food from the eighth to the tenth month, and accept its presence as a sure indication of hepatic inefficiency, basing their belief on the theory of Mellanby and of Gottlieb and Stangassinger<sup>6</sup> that creatinin is formed from creatin in the liver. Confirmation of their observation is found in Case 3 of the present series, where only creatin-free food was given. Creatin was absent from the urine (Table IV) on only two days of the antepartum period. It is present also on every day of the antepartum period in Cases 1 and 2, when the food contained creatinin but probably no creatin (see note on page 47).

<sup>1</sup> Cf. Shaffer *Am J of Physiol.*, 1908, xxix, p. 1.

<sup>2</sup> Cf. Amberg and Mornill, *J. Biol. Chem.*, 1907, iii, p. 311; Sedgwick, *J. Am. M. Ass.*, 1910, lv, p. 1778; Van Hoogenhuyze and ten Doeschate, loc. cit.

<sup>3</sup> Rose *J. Biol. Chem.*, 1911, x, p. 265.

<sup>4</sup> Murlin *Am J Physiol.*, 1908, xxix, Proceedings p. xxxi.

<sup>5</sup> Murlin *Am J Physiol.*, 1911, xxviii, p. 422.

<sup>6</sup> Mellanby, *J. of Physiol.*, 1908, xxxvi, p. 447; Gottlieb and Stangassinger, *Ztschr. f. physiol. Chem.*, 1907, li, p. 1, and 1908, li, p. 317.



TABLE IV CASE 3—(MRS D. A.) PRIMIPARA

Date, 1936	N in Food (estimated)	NITROGEN FRACTIONS IN URINE—GRAMS										PER CENT OF TOTAL N					SULFUR FRACTIONS				PER CENT OF TOTAL S		
		Total N	NH <sub>4</sub> N	Urea N	Urea + NH <sub>4</sub> N	Formol tit	Crea in N	Crea in N	NHa	Urea	Urea + NH <sub>4</sub>	Formol tit	Cr	Total ex- counted for	Total S	Inorg S	Ether Solub S	Neutr S	Inorg	Ether	Neutr		
June 1-2	8.8	7.60	0.40	5.81	6.30	0.22	0.13	0.0	6.5	16.4	82.9	2.9	1.7	0.0	87.5	0.35	0.43	0.05	0.07	78.3	9.1	12.6	
June 3-4	8.8	7.45	0.67	5.53	6.30	0.16	0.05	0.05	0.0	75.6	84.6	2.1	2.1	0.7	89.5	0.32	0.45	0.05	0.02	86.6	6.6	3.8	
June 5-6	8.9	7.43	0.43	5.33	5.76	0.18	0.09	0.09	5.8	72.8	77.6	2.4	3.1	1.9	84.3	0.33	0.42	0.04	0.07	79.5	7.5	13.2	
June 7-8	8.0	7.55	0.43	5.93	6.36	0.16	0.11	0.11	5.7	28.6	84.3	2.1	2.8	1.5	90.7	0.35	0.43	0.04	0.08	78.3	7.3	14.5	
June 9-10	8.7	7.30	0.30	5.66	6.25	0.17	0.13	0.03	5.3	80.3	85.6	2.3	2.6	1.6	90.2	0.37	0.30	0.04	0.09	75.0	7.7	17.3	
June 11-12	8.0	5.89	0.37	4.37	4.94	0.11	0.22	0.06	5.3	77.7	84.0	1.8	3.7	1.0	90.5	0.44	0.33	0.09	0.12	82.8	6.8	20.2	
June 13-14	8.9	7.12	0.43	4.85	5.18	0.18	0.06	0.0	5.8	77.7	84.0	2.5	3.2	0.8	87.3	0.33	0.40	0.05	0.08	75.5	9.4	15.1	
June 15-16	8.9	7.12	0.56	5.17	5.73	0.20	0.13	0.06	7.9	72.6	80.5	2.8	4.1	0.7	89.8	0.43	0.33	0.03	0.07	76.8	7.7	13.4	
June 17-18	7.2	5.31	0.50	3.87	4.37	0.14	0.28	0.01	5.1	75.1	81.2	2.6	3.8	0.1	86.1	0.33	0.42	0.05	0.06	79.2	0.4	11.4	
June 19-20	7.8	7.40	0.38	5.70	6.08																		
Average 1st P <sub>2</sub> d	8.55	7.03	0.46	5.30	5.69	0.17	0.20	0.08	6.7	75.9	82.6	2.4	3.0	0.9	83.6	0.32	0.42	0.04	0.07	78.1	8.1	13.8	
June 21-22	7.2	6.50	0.36	4.87	5.23	0.25	0.30	0.01	5.4	74.3	76.6	3.8	4.6	0.2	88.2	0.47	0.37	0.05	0.05	78.8	10.6	10.6	
June 23-24	6.8	5.61	0.31	4.06	4.37	0.13	0.20	0.0	5.5	72.4	77.9	2.3	3.2	0.0	85.4	0.30	0.30	0.06	0.05	72.0	15.4	7.6	
June 25-26	8.6	6.61	0.38	4.67	5.05	0.22	0.23	0.03	5.8	70.7	76.5	3.3	4.4	0.5	81.7	0.46	0.36	0.05	0.05	78.2	10.9	10.9	
June 27-28	8.9	6.38	0.20	4.50	4.81	0.20	0.23	0.02	5.3	70.7	76.5	3.3	3.5	0.3	80.3	0.47	0.37	0.03	0.07	78.7	6.4	14.9	
June 29-30	8.9	6.30	0.30	4.24	4.54	0.16	0.26	0.02	4.8	65.4	73.2	2.6	4.2	0.3	80.3	0.45	0.37	0.05	0.03	71.3	11.1	6.6	
June 31-32	6.6	5.80	0.28	4.72	5.00	0.19	0.20	0.02	4.8	80.3	85.6	3.2	4.9	0.5	93.4	0.46	0.31	0.07	0.08	67.4	15.2	17.4	
June 1-12	8.9	6.60	0.20	4.71	5.00	0.16	0.30	0.0	4.3	70.4	74.7	2.4	4.5	0.3	83.0	0.33	0.30	0.09	0.05	73.6	17.0	0.4	
June 13-14	8.3	6.10	0.37	4.17	4.54	0.22	0.20	0.02	6.0	68.4	74.4	3.6	4.7	0.3	83.0	0.31	0.30	0.06	0.09	70.7	11.8	17.7	
June 15-16	8.8	6.05	0.40	4.56	5.06	0.16	0.24	0.01	6.6	77.0	83.6	2.7	4.0	0.3	90.6	0.43	0.31	0.05	0.07	72.2	11.6	16.2	
June 17-18	8.9	5.69	0.28	4.60	4.88	0.18	0.27	0.06	4.9	80.8	85.7	3.2	4.7	1.1	94.7	0.45	0.35	0.05	0.05	76.8	11.1	11.1	
Average 2d P <sub>2</sub> d	8.12	6.20	0.30	4.67	4.77	0.18	0.28	0.02	5.3	73.6	78.9	3.0	4.5	0.4	86.9	0.46	0.35	0.05	0.06	75.7	12.2	12.2	
June 29-30	8.6	7.63	0.22	5.80	6.02	0.20	0.28	0.03	5.9	76.0	78.0	2.6	3.7	0.4	85.6	0.51	0.41	0.05	0.08	76.0	9.3	14.7	
June 31-32	8.6	6.54	0.22	5.80	6.02	0.20	0.28	0.03	5.9	76.0	78.0	2.6	3.7	0.4	85.6	0.51	0.41	0.05	0.08	76.0	9.3	14.7	
June 1-12	8.9	8.73	0.22	7.61	7.91	0.22	0.30	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	
June 13-14	8.5	10.13	0.22	8.86	9.08	0.22	0.30	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	
June 15-16	8.5	10.13	0.22	8.86	9.08	0.22	0.30	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	
June 17-18	7.5	9.06	0.22	7.53	7.75	0.14	0.28	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	
July 1-2	8.9	10.43	0.22	8.86	9.08	0.22	0.30	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	
July 3-4	8.9	8.34	0.22	7.53	7.75	0.14	0.28	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	
As Postpartum	8.55	6.18	0.22	7.41	7.63	0.19	0.28	0.0	8.8	86.7	86.7	2.1	..	..	..	73.0	0.66	0.05	0.05	82.2	6.9	10.9	

1 Child born June 21, p. m.

milligrams less (average) in the earlier ten-day period, when more protein food was being taken. This would seem to indicate that there is something characteristic about the appearance of more creatinin in late pregnancy. The same phenomenon was noted in two out of four pregnancies in the dog. Van Hoogenhuyze and ten Doeschate failed to observe it in their normal pregnancies, probably because in only one case out of seven in which this fraction was determined did they continue their observations later than one month previous to confinement. As we shall see presently, they think they have found in the excretion of creatin during pregnancy evidence of a distinct hepatic inefficiency, but they do not appear to realize that their theory really demands a decrease in the amount of creatinin excreted, and this their tables do not clearly show.

On no theory of hepatic inefficiency can an absolute increase in creatinin be explained. Two other possibilities suggest themselves: (1) that the creatinin excretion is roughly proportional to the mass of uterine muscle just as it is known to be for the mass of skeletal muscle,<sup>1</sup> and that the increase in mass of the uterine wall in the last weeks of pregnancy is responsible; or, (2) that creatin is formed in the fetus late in pregnancy as it is in the infant,<sup>2</sup> and is excreted through the maternal organs. Rose<sup>3</sup> has analyzed the muscles of a new-born infant and found 0.7 per cent of creatin. If this substance is the mother substance of creatinin, it would seem that some creatinin should be produced before birth.

#### CREATIN

The behavior of this fraction before and after parturition is just the reverse of that of creatinin, namely, a greater quantity, in both absolute and relative terms, after parturition than before. The presence of creatin in large quantity in a postpartum urine was first reported for the woman by Shaffer (loc. cit.) in October, 1908, and by the writer<sup>4</sup>

for the dog in December of the same year. Shaffer gave the correct interpretation of its presence as due to the involution of uterine muscle, and the writer noted that it reached its maximum for the dog on the fifth day postpartum. More recently the writer<sup>5</sup> has called attention to the fact that the creatin apparently is eliminated earlier than most autolytic products which (present in large quantity relatively in the dog) are excreted as constituents of the undetermined nitrogen. From Tables II and III it may be seen that the creatin excretion in these observations presents two maxima, one on the second or third day postpartum and the other on the eighth day. The first may perhaps be due simply to a squeezing out of extractives while the uterus is rigidly contracted, and the second to the liberation of creatin by a true disintegration of the muscle tissue. Creatin is not to be regarded as a true product of autolysis, since it exists preformed in the muscle.

Why does creatin appear in the antepartum urines? Since the publication of Folin's work in 1905, it has been generally believed that creatin is not a normal constituent of adult urines unless creatin is being ingested in the food. In other words, when present it is regarded as a sign of undernutrition or of actual disintegration of muscular tissue. Van Hoogenhuyze and ten Doeschate (loc. cit.) report its occurrence in a series of normally pregnant subjects on creatin-free food from the eighth to the tenth month, and accept its presence as a sure indication of hepatic inefficiency, basing their belief on the theory of Mellanby and of Gottlieb and Stangassinger<sup>6</sup> that creatinin is formed from creatin in the liver. Confirmation of their observation is found in Case 3 of the present series, where only creatin-free food was given. Creatin was absent from the urine (Table IV) on only two days of the antepartum period. It is present also on every day of the antepartum period in Cases 1 and 2, when the food contained creatinin but probably no creatin (see note on page 47).

<sup>1</sup> Cf. Shaffer, *Am J of Physiol.*, 1908, xxiii, p. 1.

<sup>2</sup> Cf. Amberg and Morrill, *J Biol Chem* 1907, iii, p. 311; Sedgewick, *J. Am M. Ass.* 1910, iv, p. 1178; van Hoogenhuyze and ten Doeschate, loc. cit.

<sup>3</sup> Rose, *J Biol Chem.* 1911, x, p. 265.

<sup>4</sup> Murlin, *Am J Physiol.*, 1908, xxiii, Proceedings, p. xxxi.

<sup>5</sup> Murlin, *Am J Physiol.*, 1911, xxviii, p. 432.

<sup>6</sup> Mellanby, *J of Physiol.*, 1908, xxvi, p. 467; Gottlieb and Stangassinger, *Zschr f. physiol. Chem.*, 1907, li, p. 24, 25, 26, 27, 28, 29, 30, 31, 32.

Mention has been made above of one serious objection to the explanation given by van Hoogenhuyze and ten Doeschate, namely, that an hepatic inefficiency would seem to demand a decrease in the excretion of creatinin corresponding to the increase of creatin. A better explanation, it seems to the writer, is one similar to that given by Rose (loc cit) for the presence of creatin in the urine of growing children. Mendel and Rose<sup>1</sup> have demonstrated the intimate relationship between the creatin metabolism and the supply of carbohydrates in the food. Following out this idea, Rose supposes that the carbohydrate is used up so rapidly in the synthetic processes of growth that it does not avail to prevent the elimination of creatin. Similarly, in pregnancy it may well be that an actual deficiency of carbohydrate in the maternal circulation exists because of the ready and rapid diffusion of dextrose through the placenta and its fixation in the foetal tissues.

#### TOTAL PERCENTAGE ACCOUNTED FOR

Because the purin nitrogen was not determined in these urines, it seems better not to speak of the nitrogen remaining after subtraction of the several fractions as "undetermined" or "rest nitrogen," but simply to add the percentages accounted for. Naturally this total in the antepartum period of Case 3 is not comparable with the total in the other cases, and cannot be given at all for the postpartum period of Case 3. The four fractions determined in Case 1 give the same total for the antepartum as for the postpartum period. The figures are slightly different for Case 2

#### THE SULPHUR IN THE URINE (N:S RATIO)

Since sulphur is a constituent of the great majority of food and tissue proteins, the output of this element may be used as an index of protein metabolism quite as well as that of the nitrogen. The ratio of the two elements one to another (N:S) in the urine is very constant under any given dietary condition. Benedict found the N:S ratio on the fifth, sixth, and seventh days of starvation to be 16.2:1,<sup>2</sup> and Cathcart<sup>3</sup> found it to be

15:1 as the average for a fourteen-day fast. According to the figures given by Hamalainen and Helme,<sup>4</sup> the ratio on a mixed and adequate diet varied between 10.2 and 14.6, with an average of 12.2. It would appear from this that a well-nourished person would excrete through the kidney more sulphur in comparison to the nitrogen than a starving person.

So far as known to the writer, attention has never been directed to this ratio for the pregnant subject. From *Holstrom's* tables (loc cit), however, it may be learned that the ratio for the entire period from the 17th to the 40th week of pregnancy is 11.9, and for the 39th and 40th weeks alone 12.4 and 12.2, respectively. For the three cases here reported the average ratio for the entire antepartum period is as follows: Case 1 (4 days), 13.8, case 2 (20 days), 13.1; case 3 (20 days), 13.5 — somewhat higher, therefore, than *Holstrom's* figure for the entire period of his observations. The difference may possibly be accounted for by the difference in potential energy of the food, his single patient receiving considerably more per unit of weight than either of the three of this series.

For the postpartum period the ratios in two of the cases are slightly higher than for the antepartum period, namely 14.7 and 13.4 as against 13.8 and 13.1. For the third case, where the average does not include the first four days of puerperium, the days when the diet was very restricted, the ratio is slightly lower in the postpartum period, 13.3 as against 13.5.

It is worthy of note that the same days which mark the sudden increase in the output of urinary nitrogen (see p. 45) witness also a corresponding increase in the output of the total sulphur (Tables II and IV).

#### PARTITION OF THE SULPHURS

In the pregnant dog it was observed that the inorganic sulphate sulphur, like the urea-plus-ammonia nitrogen, was low in percentage where the nitrogen retention was greatest and that the neutral sulphur behaved in a reciprocal sense. In these cases also it is evident that the lowest percentage of in-

<sup>1</sup> See Lusk, *Science of Nutrition*, 2nd ed. 1909, p. 67 et seq.

<sup>2</sup> Cathcart *Biochem. Ztschr.*, 1907, vi, p. 100.

<sup>3</sup> *Skand. Archiv f. Physiol.* 1907, xix, p. 152.

<sup>4</sup> Mendel and Rose *J. of Biol. Chem.*, 1917, x, p. 275.

organic-sulphate sulphur, like that of the urea-plus-ammonia nitrogen, coincides with the highest retention of nitrogen (Case 3, second antepartum period), and the highest percentage coincides with the lowest retention (Case 1). The reverse is true of the neutral sulphur only in Case 1. It probably would have been true of Case 3 but for the high percentage of ethereal-sulphate sulphur, due to indicanuria caused by the milk diet.

As emphasized in the paper on the pregnant dog, this higher percentage of neutral or unoxidized sulphur does not indicate a condition of suboxidation in normal pregnancy, as held by Zweifel<sup>1</sup> and others; for there is no increase in the absolute sense, and the total oxidation per unit of weight is just as great in the pregnant as in the non-pregnant woman.<sup>2</sup> The distribution of the sulphurs indicates that the sulphur which is excreted as inorganic sulphate is the sulphur held back for growth of the product of conception (uterus, membranes, placenta, foetus).

The similarity between the antepartum and postpartum periods extends also to the percentage distribution of the different sulphur fractions. The case which shows the highest percentage of inorganic-sulphate sulphur and the lowest percentage of neutral sulphur in the antepartum period shows the same for the postpartum period. Likewise the case which shows the lowest (average for entire period) percentage of inorganic-sulphate sulphur in the former exhibits the same in the latter.

Summarizing all these resemblances between the two periods, it is evident that the maternal organs of excretion have very much the same work to do, in the qualitative sense at least, immediately after the child is born as immediately before.

#### SUMMARY

1. In three cases of normal pregnancy followed by normal puerperium, the distribution of the nitrogen and sulphur fractions of the urine was very nearly the same in the antepartum and postpartum periods.

2. The total nitrogen in the urine shows a

sudden increase, independently of the nitrogen in the food, at about the sixth or seventh day postpartum.

3. The nitrogenous autolytic products from the uterus are for the most part converted to urea before excretion.

4. The ammonia nitrogen is slightly higher in the antepartum period than in the postpartum period.

5. The urea-plus-ammonia nitrogen in the antepartum period is lowest in percentage of the total nitrogen, when the retention of nitrogen is probably greatest. This confirms the idea, expressed elsewhere for the dog, that the nitrogen held back for growth of the product of conception is potentially urea or ammonia nitrogen.

6. The "formol-titrating" fraction is the same after delivery as before.

7. The creatinin nitrogen is higher, both relatively and absolutely, before delivery than after, the creatin nitrogen higher in both senses after delivery than before. There is no indication in the urine of hepatic inefficiency in late pregnancy.<sup>3</sup> Creatin in the urine before delivery may indicate a lack of carbohydrate in the food, after delivery it is always present during the involution period.

8. The N:S ratio in the urine of these patients was slightly higher than is usually found on an adequate diet. Because less food was ingested immediately after delivery than before, the ratio was higher in the postpartum period.

9. The inorganic-sulphate sulphur was lowest in percentage of the total sulphur where the retention of nitrogen was (probably) greatest, and highest where the retention was least. The neutral sulphur was least in percentage where the retention was least, but, owing to indicanuria, was not greatest where the retention was greatest.

10. A high percentage of neutral or unoxidized sulphur does not indicate diminished oxidation in the pregnant subject.

11. The distribution of the sulphur fractions indicates that the sulphur which is excreted as inorganic sulphate is the sulphur held back for foetal development.

<sup>3</sup>This conclusion has recently been reached also by Th. Heynemann (Ztschr. f. Geburtsh. u. Gynäk., 1912, lxxi p. 210) whose paper was received after this one had gone to press.

<sup>1</sup>Zweifel, *Archiv f. Gynäk.* 1904 lxxi p. 2.  
<sup>2</sup>Cf. L. Zuntz, *Archiv f. Gynäk.* 1910 xc p. 457, and Carpenter and Murlin 1912 loc. cit.

beginning proliferative osteo-arthritis can be detected. This is probably the result of irritation. (See Fig. 3.)

The irritation of a foreign body in a joint may lead to a proliferative process in bone, and is another example of irritative traumatic osteo-arthritis. Fig. 4 is the radiograph of an ankle-joint which contained a small, loose piece of bone, (b) indicates the loose piece of bone and (a) shows the proliferative osteo-arthritis change at the lower edge of the tibia.

It has been demonstrated, therefore, that trauma, in its various forms, can produce not only an arthritis but also a chronic proliferative osteo-arthritis.

The chronic joint diseases known as Heberden's nodes, osteo-arthritis of the knees, *malum coxae senilis*, and spondylitis deformans have all been grouped together by recent observers. Thus, Goldthwait has designated this class of chronic joint diseases "hypertrophic arthritis," while Jones groups them all under the head of "osteo arthritis." Jones summarizes the chief characteristics of "osteo-arthritis," as follows: "It is a disease rarely met with under forty years of age. The mode of onset is generally insidious, never really acute. It attacks both sexes equally. Although it may be polyarticular, its specific tendency is to be monoarticular, or, more accurately speaking, oligoarticular, with no marked leaning toward symmetrical distribution. It displays a marked predilection for attacking the large joints, such as the hip and shoulder. Constitutional symptoms, such as emaciation, rapid pulse, pyrexia, pigmentation and trophic disturbances, are generally absent. Muscular atrophy is slight, hardly ever pronounced, likewise muscular spasm and contracture. Local characters of the articular swelling, general swelling, if present, due to synovial effusion, not to peri-articular thickening, hence no spindle-shaped appearance. Joint abrupt and nodular in shape. Displacement of the bones, if present, lateral in direction. The older and more inveterate the articular lesion, the greater the enlargement of the joint."

The above mentioned diseases have been grouped together by Jones, Goldthwait, and

others, because their characteristic pathological lesion is a chronic proliferative change in the bone; in other words, a chronic proliferative osteo-arthritis. For the same reason, these diseases can be here classified under the head of traumatic osteo-arthritis, not because their etiology is known, but because the proliferative osteo-arthritis which characterizes them, in their early stage at least, is similar to that caused by known trauma.

There is nothing new in the suggestion that trauma is the cause of this class of disease. Trauma has always been given a prominent place in the etiology of *malum coxae senilis*. Hoffa has called attention to the resemblance between the anatomical lesions of so-called osteo-arthritis and traumatic arthritis, and suggests that in many instances a long forgotten trauma may have supplied the initial impulse to the morbid process. Bowlby has shown that intra-articular hæmorrhages can initiate osteo-arthritis changes in the subjects of hæmophilia. Without speculating further as to the form of trauma which can cause this class of disease, the fact remains that the initial lesion, as shown by the X-ray, corresponds to that of a traumatic osteo-arthritis.

Fig. 5 is a radiograph which shows the earliest change which can be demonstrated by the X-ray in cases of proliferative osteo-arthritis in the knees. It will be noticed that there is a squaring of the patella as compared to a normal patella. The small rice shaped body, posterior to the joint, is probably a sesamoid bone in the external head of the gastrocnemius muscle. Fig. 6 shows the squaring of the patella somewhat more advanced, while Fig. 7 shows a slight spur formation at the lower and posterior surface of the patella. Compare the bony lesion here shown with the proliferative bony change in an ankle-joint irritated by a foreign body (Fig. 4), and in a knee-joint the subject of villous arthritis (Fig. 3), and it will be seen that they are the same, or very similar. Fig. 8 is the radiograph of a case in which the spur formation has become more marked, and, in the case shown in Fig. 9, the spur formation has become very pronounced. Fig. 10 shows the radiograph of a case of advanced pro-



Fig 1

Fig 2

Fig 1 Traumatic osteo-arthritis of a finger joint, due to the joint's having been injured by a baseball. Note the proliferative osteo-arthritis and suggestion of spur formation as indicated by the arrow

Fig 2 Traumatic osteo-arthritis, metatarsophalangeal joint of the big toe in hallux valgus. The arrows indicate the spur like character of the proliferative osteo-arthritis

liferative osteo-arthritis of the knee. There are spurs on the upper and lower edges of the patella and there are also spurs on the articular surfaces of the femur and tibia. Fig 11



Fig 3 Traumatic osteo-arthritis of the knee-joint due to villous arthritis. The arrow indicates a spur on the upper and posterior edge of the patella showing proliferative osteo-arthritis



Fig 4 Traumatic osteo-arthritis of the ankle joint due to a foreign body, (a) spur formation, (b) foreign body in ankle-joint

shows a still further advanced case of proliferative osteo-arthritis of the knee; the proliferative bone changes have become very marked and secondary degenerative and



Fig 5 Traumatic osteo-arthritis of the knee-joint, "Osteo-arthritis" (Jones) Early stage. Note squaring of the patella

## THE CLASSIFICATION OF ARTHRITIS

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THE classifications of injuries and diseases of the joints have always been more or less confusing. This confusion has occurred mainly in the classification of the chronic diseases, and has been due to a lack of knowledge of their etiology, a misunderstanding of pathological findings, and the ambiguity which has arisen from individual observers describing the same disease under different names, or applying the same name to widely differing conditions.

Within the last few years, however, this confusion has become less. The tendency at the present time is to divide chronic arthritis into two main classes, one class being characterized by hypertrophic and the other by atrophic lesions. The term arthritis deformans, which in the past has often been used to designate a clinical entity or specific condition, is now usually employed in a general manner to include both hypertrophic and atrophic forms of chronic joint diseases, and there is an indication that eventually this term will be dropped.

Goldthwait classified the chronic diseases of the joints into infectious, atrophic and hypertrophic arthritis. Under the head of hypertrophic arthritis, he groups such diseases as Heberden's nodes, *malum coxae senilis* and *spondylitis deformans*.

Jones, in his recent book entitled "Arthritis Deformans," makes only two classes—rheumatoid arthritis (corresponding to Goldthwait's atrophic arthritis) and osteo arthritis (corresponding to Goldthwait's hypertrophic arthritis).

Nathan, in the *Journal of the American Medical Association* for June 17, 1911, divides the chronic joint diseases into inflammations or infections and degenerations, i. e., trophic diseases. He subdivides these into arthritis or osteo-arthritis, depending upon whether the soft parts or the bony parts of a joint are affected thus:

- I Inflammations or infections.
  - a Infectious arthritis
  - b Infectious osteo-arthritis.
- II Degenerations, i. e., trophic diseases.
  - a. Trophic arthritis
  - b Trophic osteo arthritis.

The degenerative or trophic diseases he further subdivides as follows:

- a Trophic arthritis
  - 1 Metabolic arthritis
- b Trophic osteo-arthritis
  - 1 Senile osteo-arthritis
  - 2 Neurotic osteo-arthritis
  - 3 Metabolic osteo-arthritis.

In this classification, senile osteo-arthritis corresponds to Goldthwait's hypertrophic arthritis and Jones' osteo arthritis, and metabolic osteo arthritis corresponds to Goldthwait's atrophic arthritis and Jones' rheumatoid arthritis.

It will be seen therefore, that even now there is considerable ambiguity in the classification of joint diseases.

Nichols and Richardson, in the *Journal of Medical Research* for 1909, xvi, 149, reported an extensive study, with autopsy findings of sixty five cases of chronic joint disturbance of the hypertrophic and atrophic types. They found that the cases fell into two categories—proliferative and degenerative. The result of their work has been well summarized in an editorial in the *Journal of the American Medical Association* for December 4, 1909, and on account of its direct bearing on the classification of chronic joint diseases the following quotation from the editorial will be of interest.

"It being a general law of pathology that the same agent may cause either proliferation or degeneration, in accordance with concentration, tissue nutrition, and other factors, it follows that these two pathological groups do not correspond to two different sets of etiological factors or to two different diseases, but merely represent different effects from similar causes, or similar effects from different causes;

clinically, however, there are well marked differences, corresponding to the degenerative and proliferative types of joint changes, when either of these types occur in a sufficiently distinct way, but since the presence of proliferative changes in one part of a joint may cause degenerative changes in another part, or conversely, it is evident that both anatomic changes and clinical manifestations are often of mixed character. It is also evident that, once the injury in the joint has been started, a vicious circle is readily established, for a primary degenerative change may start up proliferative processes in the neighborhood, and these, causing degeneration of opposed surfaces, the process becomes progressive, hence the bad prognosis of arthritis deformans and the mixed anatomic picture which has caused so much confusion of classification and pathology. Once the joint injury has become well established, therefore, the pathologic changes may continue even when the original etiologic factor has disappeared, and when this factor is a chronic persisting one the course of the disease must necessarily be downward."

The work of Nichols and Richardson is of great importance in explaining the pathology of that group of chronic joint disease commonly designated by the term arthritis deformans, but there are objections to their conclusion that the two types (degenerative and proliferative) making up the group are only different manifestations of the same diseased condition. There is such a difference in the two types in their initial lesion as shown by the X-ray (to be demonstrated later) and their clinical manifestation is so distinct that they should be classified separately.

As Nichols and Richardson have pointed out, the pathological changes characterizing the group are either proliferative or degenerative; moreover, one pathological change may lead to the other, and *vice versa*. It would be well, therefore, in considering these two types to avoid a classification based on pathological changes; also in classifying to avoid a term like rheumatoid arthritis, which in itself means nothing; and there is no more reason in using the term osteo-arthritis to designate a specific class of joint disease than there would be to call a certain disease of the heart, heart disease, and give all other diseases of that organ individual names. A classification of joint diseases, based upon known etiologic and anatomical factors, seems to offer the least opportunity for confusion.

The recognized factors which can cause arthritis are three in number, viz.: trauma, infection and trophic action. These etiological factors acting on the tissues of the joint cause either an arthritis or an osteo-arthritis, according to whether the soft parts of the joint alone, or the bony parts also, are affected.

A classification from an etiological and anatomical standpoint would, therefore, be as follows:

- I. Traumatic.
  - a. Traumatic arthritis.
  - b. Traumatic osteo-arthritis
- II. Infectious.
  - a. Infectious arthritis.
  - b. Infectious osteo-arthritis
- III Trophic
  - a. Trophic arthritis
  - b. Trophic osteo-arthritis

Traumatic arthritis may be caused by direct violence to a joint, by the use of a joint at a disadvantage, as in so-called static arthritis of the knees in certain cases of flat foot, and finally, from chronic irritation due to other causes such as loose bodies in the joint, anatomical abnormalities, etc. Possibly, also, circulating toxins cause a chronic irritation in joints, but, so far as the writer knows, there is no direct experimental proof of this.

Villous arthritis of the knees, as described by Goldthwait, may properly be classified as a traumatic arthritis; the cause seems to be either a static trauma or a chronic irritation.

A chronic traumatic osteo-arthritis, proliferative in character, can apparently be caused by simple trauma. Fig 1 shows the radiograph of a finger-joint that was injured by a baseball several years before. There is present a general proliferative osteo arthritis of the ends of the bones and a suggestion of spur formation. Somewhat the same condition, but with more pronounced spur formation, can be found in certain cases of hallux valgus. The abnormal position of the big toe causes repeated trauma to the metatarsophalangeal joint, and a radiograph may show an osteo-arthritis with small bony spurs. (See Fig. 2.)

In certain cases of villous arthritis, a slight





Fig 6 Traumatic osteo-arthritis of the knee joint, "osteo-arthritis" (Jones). Later stage than Fig 5. Squaring of the patella more marked

atrophic changes have taken place. This bears out the findings of Nichols and Richardson that atrophic changes occurred secondarily in proliferative processes in the joint.



Fig 7 Traumatic osteo-arthritis of the knee-joint "osteo-arthritis" (Jones). Later stage than Fig 6. arrow indicates a spur formation



Fig 8 Traumatic osteo-arthritis of the knee joint, "osteo-arthritis" (Jones). Later stage than Fig 7. Spur formation more marked

In like manner a series of radiographs of the disease known as "Heberden's nodes" will show the initial demonstrable X-ray lesion to be a proliferative osteo-arthritis, also that this proliferative osteo-arthritis increases in degree until in the later stages degenerative changes occur.

The X ray of a normal finger-joint (Fig 12) shows the joint edges of the bone rounded in outline and the articular ends somewhat rarefied as compared to the shaft. The first demonstrable X-ray lesion of a proliferative osteo arthritis (Heberden's nodes) begins as a thickening and squaring of the bone at the articulation, but there is no increase of rarefaction (Fig 13). The squaring becomes more pronounced with a suggestion of spur formation (Fig 14). This is followed by actual spur formation (Fig 15) which gradually becomes more marked and is associated with proliferative changes in the entire articular end of the bone (Fig 16). Fig 17 shows the spur formation and other proliferative changes still more marked. In this case degenerative and atrophic changes are taking place, as is shown by the rarefying of the bone. In Fig 18 the proliferative and atrophic changes have both increased, while



Fig 9 Traumatic osteo-arthritis of the knee-joint, "osteo-arthritis" (Jones) Later stage than Fig 8 Spur formation pronounced

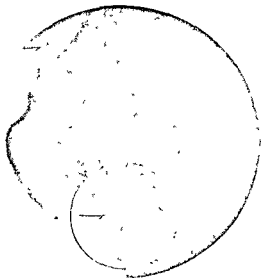


Fig 10 Traumatic osteo-arthritis of the knee joint "osteo-arthritis" (Jones) Later stage than Fig 9 The arrows indicate spurs on the femur and tibia

in Fig. 19 the atrophic changes can almost be said to predominate

Fig 20 shows the radiograph of a beginning case of *malum coxae senilis*. Note the proliferative osteo-arthritis which shows itself as a hook-like spur on the edge of the acetabulum.

Fig 21 shows a spur formation on the vertebra. The subsequent history of this case is not known, but it would seem that sooner or later it must have shown symptoms of *spondylitis deformans*

Fig 22 is an anterior posterior view of the neck of a patient who suffered from a left sided spasmodic torticollis associated with pain. The radiograph shows a proliferative osteo-arthritis of the transverse processes on the left side of the cervical vertebrae

In a summary of the above it can be said that trauma is an important etiological factor in arthritis and osteo-arthritis, that the characteristic lesion of a traumatic osteo-arthritis is a proliferative osteo-arthritis, and that the characteristic lesion of the diseases grouped together under the head of "hypertrophic arthritis," or "osteo arthritis," is a proliferative osteo arthritis, which in its early stage cannot be distinguished from the

proliferative osteo arthritis produced by known trauma

Infection as an etiological factor in causing joint disease is well understood and no discus-

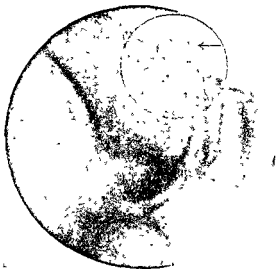


Fig 11 Traumatic proliferative osteo-arthritis of the knee joint, "osteo-arthritis" (Jones) Later stage than Fig 10 The arrow indicates an area of proliferative arthritis which is undergoing secondary degeneration



Fig 12

Fig 13

Fig 14

Fig 15

Fig 12 Normal finger joint

Fig 13 Traumatic osteo-arthritis of finger joint (Heberden's node), early stage. Note slight thickening and squaring of the bone at the articulation

Fig 14 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 13. Squaring more pronounced with a suggestion of spur formation

Fig 15 Traumatic osteo-arthritis of finger joint (Heberden's node) later stage than Fig 14. Spur formation

Fig 16 Traumatic osteo-arthritis of finger joint (Heberden's node) later stage than Fig 15. Spur for-



Fig 16.

Fig 17.

Fig 18

Fig 19

mation more marked. Proliferative changes in the entire articular end of the bone

Fig 17 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig 16. Spur formation and other proliferative changes more marked. Degenerative and atrophic changes have also taken place, as is shown by the rarefying of the bone.

Fig 18 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig 17. Proliferative and atrophic changes have both increased

Fig 19 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig 18. Atrophic changes almost predominate.

sion as to infectious arthritis or osteo-arthritis caused by various known organisms is necessary. In the main it can be said that infectious arthritis is characterized by synovitis and suppuration and infectious osteo-arthritis is characterized by degenerative changes in the bone

Trophic action is the third great causative

factor in arthritis and osteo-arthritis and the essential characteristic of this type of disease is an atrophy or degeneration.

A well known example of a trophic osteo-arthritis is found in Charcot's joint. Fig. 23 is the radiograph of a Charcot ankle-joint; it will be seen that degenerative and proliferative changes are both present but the pre-



Fig 20 Traumatic osteo-arthritis of the hip-joint (malum coxae senilis). The arrow indicates spur formation on the edge of the acetabulum

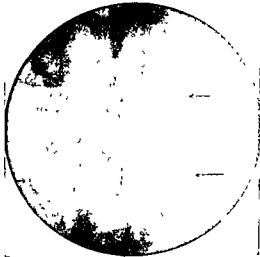


Fig 22. Traumatic osteo-arthritis of the cervical vertebra, "osteo-arthritis" (Jones). The arrow indicates the area of greatest proliferation



Fig 1.

Fig 2

Fig 1. Traumatic osteo-arthritis of a finger joint, due to the joint's having been injured by a baseball. Note the proliferative osteo-arthritis and suggestion of spur formation as indicated by the arrow.

Fig 2 Traumatic osteo-arthritis, metatarsophalangeal joint of the big toe in hallux valgus. The arrows indicate the spur-like character of the proliferative osteo-arthritis

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Fig 3 Traumatic osteo-arthritis of the knee-joint due to villous arthritis. The arrow indicates a spur on the upper and posterior edge of the patella showing proliferative osteo-arthritis

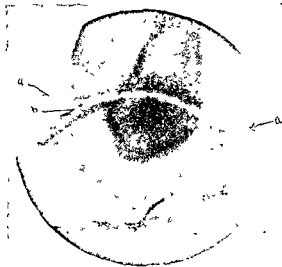


Fig 4. Traumatic osteo-arthritis of the ankle-joint due to a foreign body, (a) spur formation, (b) foreign body in ankle joint

shows a still further advanced case of proliferative osteo-arthritis of the knee; the proliferative bone changes have become very marked and secondary degenerative and



Fig 5 Traumatic osteo-arthritis of the knee-joint. "Osteo-arthritis," (Jones). Early stage Note squaring of the patella



Fig 6 Traumatic osteo-arthritis of the knee-joint, "osteo-arthritis" (Jones) Later stage than Fig 5 Squaring of the patella more marked

atrophic changes have taken place. This bears out the findings of Nichols and Richardson that atrophic changes occurred secondarily in proliferative processes in the joint.



Fig 7 Traumatic osteo-arthritis of the knee-joint, "osteo-arthritis" (Jones) Later stage than Fig 6 The arrow indicates a spur formation

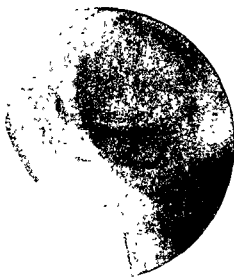


Fig 8 Traumatic osteo-arthritis of the knee-joint, "osteo-arthritis" (Jones) Later stage than Fig 7 Spur formation more marked

In like manner a series of radiographs of the disease known as "Heberden's nodes" will show the initial demonstrable X-ray lesion to be a proliferative osteo-arthritis, also that this proliferative osteo-arthritis increases in degree until in the later stages degenerative changes occur.

The X-ray of a normal finger-joint (Fig 12) shows the joint edges of the bone rounded in outline and the articular ends somewhat rarefied as compared to the shaft. The first demonstrable X-ray lesion of a proliferative osteo-arthritis (Heberden's nodes) begins as a thickening and squaring of the bone at the articulation, but there is no increase of rarefaction (Fig 13). The squaring becomes more pronounced with a suggestion of spur formation (Fig 14). This is followed by actual spur formation (Fig 15) which gradually becomes more marked and is associated with proliferative changes in the entire articular end of the bone (Fig 16). Fig 17 shows the spur formation and other proliferative changes still more marked. In this case degenerative and atrophic changes are taking place, as is shown by the rarefying of the bone. In Fig 18 the proliferative and atrophic changes have both increased, while



Fig. 9 Traumatic osteoarthrosis of the knee joint, "osteo-arthrosis" (Jones) Later stage than Fig 8 Spur formation pronounced

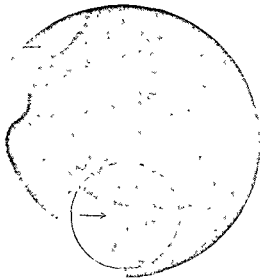


Fig. 10 Traumatic osteoarthrosis of the knee joint, "osteo-arthrosis" (Jones) Later stage than Fig 9 The arrows indicate spurs on the femur and tibia

in Fig 19 the atrophic changes can almost be said to predominate

Fig 20 shows the radiograph of a beginning case of *malum coxae senilis*. Note the proliferative osteoarthrosis which shows itself as a hook-like spur on the edge of the acetabulum

Fig 21 shows a spur formation on the vertebra. The subsequent history of this case is not known, but it would seem that sooner or later it must have shown symptoms of *spondylitis deformans*

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In a summary of the above it can be said that trauma is an important etiological factor in arthritis and osteo-arthrosis, that the characteristic lesion of a traumatic osteo-arthrosis is a proliferative osteo-arthrosis; and that the characteristic lesion of the diseases grouped together under the head of "hypertrophic arthritis," or "osteo arthritis," is a proliferative osteo-arthrosis, which in its early stage cannot be distinguished from the

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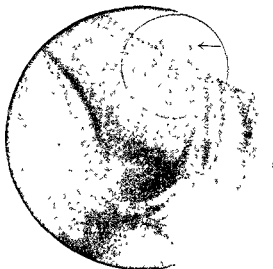


Fig. 11 Traumatic proliferative osteo-arthrosis of the knee joint, "osteo arthritis" (Jones) Later stage than Fig 10 The arrow indicates an area of proliferative osteitis which is undergoing secondary degeneration



Fig. 12

Fig. 13

Fig. 14

Fig. 15

Fig. 12 Normal finger joint

Fig. 13 Traumatic osteo-arthritis of finger joint (Heberden's node) early stage. Note slight thickening and squaring of the bone at the articulation.

Fig. 14 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 13. Squaring more pronounced with a suggestion of spur formation.

Fig. 15 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 14. Spur formation.

Fig. 16 Traumatic osteo-arthritis of finger joint (Heberden's node) later stage than Fig. 15. Spur formation more marked.



Fig. 16

Fig. 17

Fig. 18

Fig. 19

Fig. 16 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 15. Spur formation more marked. Proliferative changes in the entire articular end of the bone.

Fig. 17 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 16. Spur formation and other proliferative changes more marked. Degenerative and atrophic changes have also taken place, as is shown by the rarefying of the bone.

Fig. 18 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 17. Proliferative and atrophic changes have both increased.

Fig. 19 Traumatic osteo-arthritis of finger joint (Heberden's node), later stage than Fig. 18. Atrophic changes almost predominate.

sion as to infectious arthritis or osteo-arthritis caused by various known organisms is necessary. In the main it can be said that infectious arthritis is characterized by synovitis and suppuration and infectious osteo-arthritis is characterized by degenerative changes in the bone.

Trophic action is the third great causative

factor in arthritis and osteo arthritis and the essential characteristic of this type of disease is an atrophy or degeneration.

A well known example of a trophic osteo-arthritis is found in Charcot's joint. Fig. 23 is the radiograph of a Charcot ankle-joint; it will be seen that degenerative and proliferative changes are both present but the pre-



Fig. 20 Traumatic osteo-arthritis of the hip-joint (malum coxae senilis). The arrow indicates spur formation on the edge of the acetabulum.

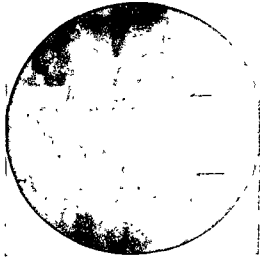


Fig. 21 Traumatic osteo-arthritis of the cervical vertebra, "osteo-arthritis" (Jones). The arrow indicates the area of greatest proliferation.



Fig 24

Fig 25

Fig 26

Fig 27

Fig 28

Fig 29

Fig 30.

Fig 24 Trophic osteo-arthritis of a finger joint (gout) Note rarefying of bone and punched-out areas

Fig 25 Trophic osteo arthritis ("rheumatoid arthritis") of a finger joint Early stage The arrow indicates the shadow of the swollen soft parts

Fig 26 Trophic osteo arthritis ("rheumatoid arthritis") of a finger joint Later stage than Fig 25 The arrow indicates rarefied area of bone

Fig 27 Trophic osteo-arthritis ("rheumatoid arthritis") of a finger joint Later stage than Fig 26 Rate

fraction increased and punched-out areas at the articular surface

Fig 28 Trophic osteo-arthritis ("rheumatoid arthritis") of a finger joint Later stage than Fig 27 Articular end of bone has worm-eaten appearance

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dominating change is degenerative. A simpler form of trophic osteo-arthritis is found in gout. Fig 25 is the radiograph of a finger affected with gout, note the rarefying osteitis and the punched-out appearance of the bone at the articular ends. This is a markedly different picture from that seen in cases of

traumatic osteo arthritis where the characteristic lesion is a proliferative osteo-arthritis.

There is another most important chronic disease of the joints, whose chief characteristic is a degeneration. For various reasons this disease has already been classified by other writers as a trophic osteo arthritis but, if for



Fig 21 Traumatic osteo-arthritis of the spine (spondylitis deformans) The arrows indicate spur formations on the vertebrae



Fig 23 Trophic osteo-arthritis of ankle-joint (Charcot's joint). Degenerative and proliferative changes are both present but degenerative changes predominate.





Fig. 31. Trophic osteo-arthritis (rheumatoid arthritis) of a knee joint. Rarefying ostitis.

no other reason it could be classified as a trophic osteo-arthritis on account of the similarity of its radiographic appearance to other degenerative diseases known to be trophic in origin. Reference is here made to the disease called by Goldthwait "atrophic arthritis" and by Jones "rheumatoid arthritis" and by Nathan "metabolic osteo arthritis."

Jones distinguishes this disease from his so called "osteo-arthritis" as follows:

"This affection differs from the foregoing (osteo arthritis) in that it is most commonly met with in persons under forty years of age. It attacks women much more frequently than men. Its specific distribution is polyarticular, with marked leaning toward symmetrical invasion of joints. It evinces a pronounced preference for the smaller joints, the hip and shoulder often remain immune. Constitutional symptoms are much more conspicuous, pulse often quickened, temperature in more acute forms raised, extreme emaciation not uncommon. Muscular spasm prominent, muscular atrophy intense and widespread with contractures. Trophic disturbances of varied nature and degree always present, such as pigmentation, vasomotor

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The gradual development of the atrophic changes in the above described disease can best be seen in a series of radiographs of the fingers. The earliest change in a joint affected by this atrophic form of disease is a swelling of the soft parts, causing them to throw a slight shadow (Fig 25). At the same time or possibly a little later a rarefaction at the lateral surface of the articular ends of the bone can be made out (Fig 26). Later the rarefaction increases and punched out areas appear at the surface (Fig 27). Later still, the rarefaction continues to increase and the articular end of the bone has a worm-eaten appearance (Fig 28). This may lead to practically a loss of the joint (Fig 29). It has already been shown how in the late stages of a proliferative osteo arthritis secondary atrophic changes may appear. On the other hand, in the later stages of an atrophic arthritis secondary changes of a proliferative nature may occur. Fig 30 shows proliferative changes even to the formation of spurs occurring in the last stages of a trophic osteo-arthritis.

Fig 31 is the radiograph of a case of atrophic osteo-arthritis affecting the knee-joint. The disease had advanced so far that there was almost complete ankylosis of the joint and yet, as can be seen, there is very little change outside of a rarefying ostitis. Compare the picture here shown with Fig 10, an advanced case of proliferative osteo-arthritis. In the latter case there is comparatively little rarefying of bone, marked exostoses are present, but with all, the normal motion of the knee was but little restricted.

The classification of arthritis based upon etiological and anatomical changes, which I wish to present and in which I believe, as

shown in this paper, all forms of arthritis and osteo-arthritis can be placed, is as follows:

### I. Traumatic

1. Traumatic arthritis.
  - a Simple traumatic inflammation synovitis
  - b Villous arthritis
2. Traumatic osteo-arthritis
  - a Bony spurs
  - b Proliferative osteo-arthritis in hal-lux valgus, in joints subject to irritation of foreign bodies, etc.
  - c Heberden's nodes
  - d Proliferative osteo-arthritis of the knees
  - e Malum coxæ senilis
  - f Spondylitis deformans

### II. Infectious

1. Infectious arthritis caused by organisms
2. Infectious osteo-arthritis caused by organisms.

### III Trophic

1. Trophic arthritis.  
Metabolic arthritis (Nathan)
2. Trophic osteo-arthritis.
  - a Charcot joint
  - b Gout
  - c Syringo-myelia
  - d Rheumatoid arthritis (Jones), atrophic arthritis (Goldthwait), metabolic osteo arthritis (Nathan)

Forms of arthritis other than the above mentioned can be placed in the classification according to their etiology and the anatomical changes characterizing them

## ETIOLOGY, PATHOLOGY AND TREATMENT OF OVARIAN CYSTS IN RELATION TO CHILD-BEARING, WITH SPECIAL REFERENCE TO HÆMORRHAGE INTO THE CYSTS

BY WALTER CLINTON JONES, A M., M D CHICAGO  
Assistant Professor of Surgical Pathology Medical Department University of Illinois

THE following unusual case, which occurred in the experience of the writer, led to the preparation of this paper.

Patient, Mrs G., Kankakee Illinois  
Family and personal histories, negative

*Present illness* On July 2d her family physician Dr E C Hamilton, delivered her of a child. Pregnancy and delivery were apparently entirely normal. Within twenty minutes after the end of the second stage, the abdomen had become greatly enlarged, so much so that the doctor thought he must have overlooked another baby in the uterus. However, on internal examination he found the uterus empty (after the delivery of the placenta) and the enlargement was thus demonstrated to be outside the uterus. There were no symptoms of hæmorrhage nor any other pathological signs, nothing but a pelvic and abdominal enlargement.

The writer saw the patient for the first time, in consultation with Dr Hamilton, on July 8th, and diagnosed a collection of fluid, probably an ovarian cyst, but I was doubtful on account of the unusual history.

The enlargement gradually increased and the patient was getting weaker so that it became

evident to Dr. Hamilton that something must be done to save the patient's life. I was called in again, just one month after the first visit. The tumor by this time had increased in size to nearly twice that of a normal pregnancy but with the prominence decidedly more marked on the left side. The patient's general condition was fairly good. The physical findings were very distinctly those of an ovarian cyst, but I still had some misgivings on account of the strange history. However, the case evidently was surgical and so I did a laparotomy.

A median incision led into a large cavity, from which was obtained more than six quarts of rather thick chocolate-colored fluid. It was evident at once that we were dealing with a cyst and that the fluid was largely hæmorrhagic in origin. Adhesions to the surrounding structures were separated with much difficulty, the pedicle, which coincided with the pedicle of the left ovary, was ligated and the cyst was removed. The tube on the same side was also ablated. An inflamed portion of the omentum about as large as a hen's egg was removed, the uterus was suspended in anterior position, and the abdomen closed. The patient withstood the operation well. She was slow in reacting but ultimately made a complete recovery.



Fig. 1. Photograph of gross specimen, writer's case. P, pedicle; O, adherent omentum. For further description see text.

#### PATHOLOGICAL ANATOMY

**Gross** (Fig. 1) The cyst arose from and included the entire left ovary. It extended upward and to the left so as to occupy this side of the abdomen more than the right, reaching well up under the costal arch. It was adherent very firmly to the abdominal wall, the omentum and the bladder, also somewhat to the intestines. The shape was ovoid and the tumor lay so that its long axis was parallel with the longitudinal axis of the body. The longer diameter, after preservation in Kaiserling solution, is about 22 cm. and the shorter one about 17 cm. Distended it holds about 5½ litres of fluid and collapsed and crushed together it fills a quart jar. The cyst is multilocular, consisting of one very large and four small sacs. These latter range in diameter from one to four cm. and are filled with clotted blood and fluid. They all lie within the wall of the large cyst. The wall of the latter varies in thickness from one mm. to two cm., while adherent to its inner surface are many partially organized clots of blood.

The uterus was markedly retroverted, the tubes were practically normal, and the appendix was normal. The abdominal wall was attenuated to about one half its normal thickness.

**Microscopical** 1. Cyst wall (Fig. 3) This consists of ordinary ovarian stroma composed of connective tissue with a considerable admixture of involuntary muscle cells. The long axis of the cells and fibres are for the most part, parallel with the surface of the cyst. There is considerable

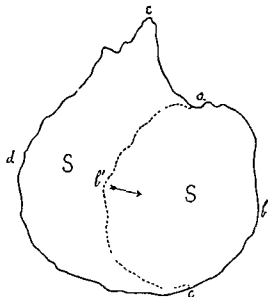


Fig. 2. Diagram of probable mechanism of the occurrence of hemorrhage in the writer's case. For description, see text p. 69.

edema, and round-celled infiltration is fairly abundant.

The most prominent pathological finding is hemorrhage, it is very abundant and corresponds to the variety which Daniel calls "hemorrhagic infiltration." In places it appears in relatively well-defined spots, while in other areas it occurs as a rather even infiltration with blood-cells.

No traces of epithelial cells lining the interior of the cyst were found. There is no evidence of degeneration nor of any other regressive change.

2. Contents of large cyst. Fluid, color, chocolate, odor, slight and of no particular character, specific gravity, 1.028. On standing, it separates into two layers of about equal thickness, an upper, chocolate-colored, and a lower, grayish. Albumen, very abundant. Microscopically, large numbers of leucocytes and much amorphous detritus were found, fluid might be said to be almost semipurulent.

Of course, the story was told as soon as the chocolate colored fluid was discovered in the cyst. When the baby was delivered, the lessening of the pressure on the concomitant ovarian cyst had allowed a sudden hemorrhage to occur into the cyst, which produced the sudden enlargement (Fig. 2). This pressure, no doubt, was a factor in stimulating the growth which caused the subsequent increase in size. It surely is remarkable that the great hemorrhage which occurred after the delivery of the child did not produce clinical signs of hemorrhage.



Fig 24

Fig 25

Fig 26

Fig 27

Fig 28

Fig 29

Fig 30

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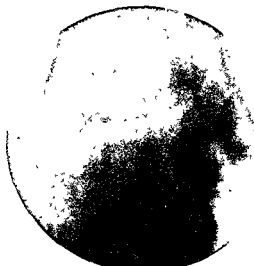


Fig 32 Trophic osteo-arthritis of ankle-joint (Charcot's joint). Degenerative and proliferative changes are both present but degenerative changes predominate.



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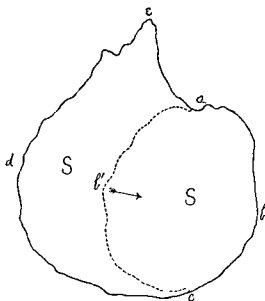


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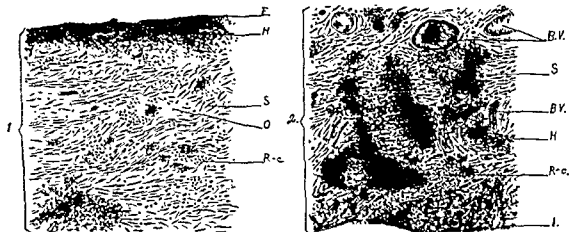


Fig. 3. Section from wall of cyst on side opposite to pedicle and in contact with abdominal wall, writer's case. 1, area including external surface, 2, area including internal surface; L, external surface, I, internal surface; S, ovarian stroma; O, (Edema); R-c, round-celled infiltration; H, areas of hæmorrhage; B V, blood-vessels. Note the thinness of the walls of the larger vesicles. X 100 (Size and outlines obtained by vision with both eyes simultaneously, one looking into the microscope and the other at the drawing sheet, thus projecting onto the paper the image in the microscope.)

I have been able to find in the literature only one case which resembles this one closely. It occurred in the practice of R. G. LeConte, and is described briefly as follows:

The patient was twenty-seven years of age. Before her last pregnancy her pelvis and abdomen were normal, as far as known. Dr. LeConte saw her six weeks after a normal child had been delivered at a normal labor. "After delivery it was noticed that the abdomen remained about as large as it had been previously." She was operated about six weeks after labor, and the cyst was found to contain nearly four gallons of "dark-brown fluid." Dr. Cattell, who made the pathological report, said it was a "multilocular cystoma of the ovary. The contents of the large cyst were of a clear grayish red color and weighed a little over thirty-two pounds avoirdupois. The smaller cysts were filled with colloid material. The size when extended with water after removal varied from eight and one-half to ten and one-half inches in the various diameters." LeConte seems to assume that the growth took place entirely during pregnancy and that there was no particularly sudden enlargement immediately after delivery.

The following cases are also somewhat similar to the writer's, especially in regard to the time of the discovery of the tumor (immediately after delivery) and as to the rapid enlargement of the growth during the early puerperium:

Marshall reports a case in which the patient stated "that after labor her abdomen remained

larger than at full time pregnancy." No tumor had been noticed by her family doctor.

Hammond relates a case in a woman who had borne six children. Subsequent to the birth of the fifth child, she noticed a swelling of the abdomen. During her sixth pregnancy, her abdomen was exceedingly large, but labor was normal. After this birth, her abdomen rapidly increased in size.

Hall tells of a patient whom he saw for the first time four weeks after delivery. "She was greatly emaciated and had a large ovarian tumor in her abdomen." He operated her eleven days later and found a "multilocular tumor of the ovary, probably malignant. . . . The tumor was first discovered immediately after delivery and was not larger than an adult head."

Patton reports a case where enlargement due to an ovarian tumor during pregnancy did not disappear after labor. Two and a half weeks later torsion of the pedicle occurred and the cyst was removed surgically.

H. R. Spencer, in a report on forty-one ovarian cysts on which he had operated, mentions the time of discovery of the tumor in seven instances as immediately after labor. (No further details are given in regard to this point.)

In reviewing the literature dealing with ovarian cysts, one is greatly hampered by the incompleteness of many of the reports. In numerous instances the most important facts are entirely omitted. However, McKerron, Williams, Patton, Lea, Daniel and many others have written excellent articles from which we can collect a large fund of useful



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The gradual development of the atrophic changes in the above described disease can best be seen in a series of radiographs of the fingers. The earliest change in a joint affected by this atrophic form of disease is a swelling of the soft parts, causing them to throw a slight shadow (Fig. 25). At the same time or possibly a little later, a rarefaction at the lateral surface of the articular ends of the bone can be made out (Fig. 26). Later the rarefaction increases and punched out areas appear at the surface (Fig. 27). Later still, the rarefaction continues to increase and the articular end of the bone has a worm-eaten appearance (Fig. 28). This may lead to practically a loss of the joint (Fig. 29). It has already been shown how in the late stages of a proliferative osteo-arthritis secondary atrophic changes may appear. On the other hand in the later stages of an atrophic arthritis secondary changes of a proliferative nature may occur. Fig. 30 shows proliferative changes even to the formation of spurs occurring in the last stages of a trophic osteo-arthritis.

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information. The most valuable of these contributions is that of McKerron.

First, in regard to the frequency of ovarian tumors during pregnancy, the following statistics from McKerron are instructive:

Flaschlen	5 times in 17,832 pregnancies
Lohlein	2 times in 1,300 pregnancies
Tarnier	1 time in 1,738 pregnancies
Total	8 times in 20,870 pregnancies
Average	1 time in 2,609 pregnancies

The frequency of cystic as compared with solid tumors of the ovary has been investigated by Kelly, Olshausen, McKerron, and others. Averaging the figures of these three men, we find that cysts constitute from eighty-five to ninety per cent of all neoplasms of the ovary. Hence one must remember when dealing with statistics which include all tumors of the ovary that nearly nine tenths of them are cysts.

As to the likelihood of encountering difficulties with ovarian tumors in relation to child-bearing, Williams says that serious trouble of one kind or another occurs in at least one fourth of those present during labor and the puerperium; while Lea holds that fifty per cent of those occurring during the puerperium cause grave symptoms.

About twenty-five per cent of all ovarian tumors occurring during pregnancy lie in the pelvis and are seldom discovered till after the onset of labor. The other seventy five per cent are abdominal in location.

#### CLASSIFICATION OF VARIOUS KINDS OF HÆMORRHAGE INTO OVARIAN CYSTS

- A. According to sequence of time and cause
  - I. Primary "Hæmorrhagic infiltration simultaneous with development of cyst" (Daniel)
  - II. Secondary An accident or complication, twisted pedicle, chief cause
- B. According to torsion of pedicle and relation to child-bearing
  - I. Torsion of pedicle (always secondary)
  - II. No torsion of pedicle (primary or secondary)
    1. Independent of pregnancy
    2. In connection with pregnancy
      - a. Before delivery
      - b. During delivery
      - c. During puerperium
- C. According to location of hæmorrhage
  - I. In cyst wall.
  - II. Intracystic.
  - III. In pedicle.
  - IV. In peritoneal cavity
  - V. In I + II or any other combination of above.

#### ETIOLOGY OF HÆMORRHAGE INTO OVARIAN CYSTS

The causes may be classified as follows, given approximately in the order of their importance:

- I. Torsion of Pedicle
- II. Associated Conditions.
  1. Pregnancy. Acts in two ways
    - a. Increases vascularity.
    - b. Favors torsion of pedicle and infection
  2. Menstruation
    - a. Increases vascularity.
    3. Age "The period of sexual activity" (Daniel)
- III. Regressive Changes: for example
  1. Rupture of vessel in partition undergoing absorption
  2. Simple necrosis
  3. Malignant degeneration.
    - a. Carcinomatous.
    - b. Sarcomatous
- IV. Trauma for example,
  1. Blows upon abdomen
  2. Incised and other wounds
  3. Pressure during examination.
- V. Sudden Reduction of Intracystic Tension
  1. Rupture of cyst
    - a. Traumatic.
    - b. Spontaneous
  2. Sudden lowering of intra-abdominal pressure, as by obstetrical delivery
  3. Tapping
- VI. Increased Blood Pressure
  1. Local
  2. General
- VII. Inflammation, especially acute

We will now consider the above outline in detail.

**I. Torsion of pedicle** A rather extensive discussion of this lesion is necessary because it is by far the most common cause of hæmorrhage into ovarian tumors, this accident occurring in about fifty per cent of all cases of torsion. The mechanism of the production of hæmorrhage from this cause is readily understood. In the first place, the twist must not be too great, for this will cut off the circulation entirely in most cases and then gangrene or possibly atrophy will supervene. However, if the pressure caused by the twist is partial or gradual, the veins are obstructed sooner than the arteries, on account of the thinner walls of the former. Thus the blood is dammed back, increasing intravenous pressure till one or more of the weaker veins are ruptured. If the pressure at the pedicle is only slight, merely passive congestion is produced.

Complete separation of the pedicle may

happen with or without hæmorrhage, leaving the tumor entirely free in the abdominal cavity (Croft).

The amount of twist necessary to produce serious results varies from ninety degrees to several turns, depending chiefly upon the length of the pedicle, a long pedicle withstanding a larger amount of torsion than a short one.

The frequency of torsion in ovarian tumors is given concisely in the tabulated form shown on page 68.

The averages in this table probably are a little too high on account of the inclusion of Aust-Lawrence's ten cases in which all but one were found to have torsion of the pedicle. Preference ought to be given to the figures of McKerron, who has collected by far the largest number of cases, and to those of Williams, who stands next to McKerron in this respect. According to both of these men, the average total is too high, and according to Williams the percentage in the child-bearing group ought to be relatively higher. So I have subtracted two per cent from both the child-bearing and the total per cent averages in order to make the conclusions, in all probability, more nearly correct.

According to practically all the authorities I have consulted, torsion of the pedicle is more common in cystic than in solid tumors, while Lea and many other writers state that dermoids suffer this accident proportionately more frequently than other cysts. "This is due," says Lea, "to their comparatively small size and slow rate of growth, on account of which they escape notice till pregnancy or some accident occurs."

The percentage of hæmorrhage in cases of torsion is shown by the following table, all of the writers being quoted by Daniel. The relation to child-bearing is not stated; probably all cases, in both the pregnant and the non-pregnant, are included.

Mouthon	8 cases	Hæmorrhage in 38 per cent
Mouls	6 cases	Hæmorrhage in 33 per cent
Baron	24 cases	Hæmorrhage in 58 per cent
Kisseloff	7 cases	Hæmorrhage in 43 per cent
Aubry	9 cases	Hæmorrhage in 56 per cent
Finaz	20 cases	Hæmorrhage in 67 per cent
Daniel	No. not stated	Hæmorrhage in 46 per cent
Total	74 plus	Average 49 per cent

Now if eighteen per cent of all ovarian tumors suffer torsion of the pedicle (see table, p. 68) and if in approximately fifty per cent of the latter, hæmorrhage occurs, the frequency of hæmorrhage for all ovarian tumors with twisted pedicles is nine per cent.

In an extensive search of the literature, I am unable to find any statistics concerning the frequency of hæmorrhage independent of torsion of the pedicle. It cannot be said to be very uncommon because I have read many reports of such cases (Libby, Lea, Lance and Theuveny, Davenport, Horsley, Boldt, Haggard, and many others). It probably is safe to assume that three per cent of all hæmorrhages occur without twisting of the pedicle. This would make a grand total of twelve per cent of hæmorrhage in all kinds of ovarian tumors. Furthermore, since hæmorrhage is far more common in cystic than in solid tumors of the ovary, and since nearly nine tenths of all ovarian neoplasms are cysts, these conclusions are approximately correct for cysts alone.

The fifty per cent in which hæmorrhage does not occur are included for the most part in the following groups:

1 Torsion not severe enough to produce hæmorrhage

2. Torsion so marked and so sudden that gangrene sets in at once. By far the greater proportion of twisted pedicles in which hæmorrhage does not occur, belongs in this group. Very many cases are reported in the literature

3 Pedicle very long so that several twists do not interfere with the circulation. For example, Hammond reports a case in which a "long pedicle contained five twists" and yet there was no hæmorrhage; while Brothers relates an instance in which the pedicle resembled an umbilical cord and was twisted three and a half times, without any evidence of impeded circulation.

4. "Vicarious nutrition from adhesions" (Haggard and others).

5. Unexplained cases in which one naturally expects hæmorrhage but it does not occur.

II. *Associated conditions.* Pregnancy acts chiefly by predisposing to torsion of the

## PERCENTAGE OF TORSION IN OVARIAN TUMORS

Kind of Tumors	Authorities	No. of Cases	In Connection with Child bearing	Independent of Child bearing	In Pregnant and Non Pregnant	Relation to Pregnancy not stated	Total Per Cent
Multilocular ovarian cystadenomata	Eyster, G. L.	Not stated			10		10
Ovarian cysts (All kinds)	Patton C. L.	310	"Complicated by pregnancy," 196				19.6
Ovarian cysts (All kinds)	Schultz Rokitansky Olschusen Keuter Douglas Jenna	Jenna 257, others not stated			20 12 6 38 16 10 14.4	As 16	16
Ovarian cysts (Various kinds)	Lea A. W. W.	7	"During pregnancy and the puerperium," 14				14
Ovarian tumors (All kinds)	Williams Sir J.	375	During pregnancy, 6				6
Ovarian cysts (Various kinds)	Flaggard W. D.	12		17			17
Ovarian tumors (All kinds)	McKerron, R. G.	1200	"During pregnancy," 12				12
do	do		"During the puerperium," 227				22.7
Ovarian cysts (All kinds)	Wells, Spencer	Not stated				"Aside from pregnancy," 8	8
"Ovarian Cystomata" (Various kinds)	Marshall, G. B.	8	During pregnancy, labor, and puerperium, 125			"Not complicated by pregnancy," 2	2
"All ovarian tumors"	Schultz (quoted by Davis)						12.5
Ovarian tumors (Various kinds)	Aust Lawrence	10	"After labor," 90			"In the non pregnant state," 216	21.6
Total No. cases		More than 21600					90
Averages			25	12	10	16	29
Corrected Averages			25	10	10	16	18

pedicle; this occurs most commonly during the puerperium. Numerous explanations have been brought forward as to why this is the case. Davis thinks that the increased room and the lessened intra-abdominal pressure are the chief factors. Movements of intestines, uterus, etc., alone or combined with movements of the whole abdomen and pelvis, probably are causes of more or less importance. The relative frequency of torsion and other accidents during the puerperium is shown by the following statistics from McKerron (all operated cases):

	Cases.	Per cent
Acute torsion	28	30
Suppuration	16	17
Acute peritonitis	12	13
Rupture of cyst	8	9
Tumor, gangrenous	2	2
Tumor, malignant	2	2
Other conditions	24	26
Total cases	92	

In twenty-nine cases of twisted pedicle of Remy's, eleven were found during pregnancy and eighteen during the puerperium. In several hundred cases collected by McKerron, twelve per cent occurred during pregnancy and twenty-two and seven-tenths per cent during the puerperium (See table, p. 68).

Pregnancy predisposes to uncomplicated infection as well as to torsion and its results, hæmorrhage, gangrene, and infection.

The influence of menstruation as an etiological factor in producing hæmorrhage into ovarian cysts probably is very small. Daniel thinks it acts chiefly by exaggerating or by bringing to light pre-existing lesions. However, Boeckel in 1861, described a distinct variety of cysts under the name of "Kystes Menorragiques." The explanation of their formation was that the Graafian follicles do not rupture, at each menstruation one more is added and thus the ovary gradually is transformed into a multilocular cyst. Hedley, Ricketts, and many others have described hæmatomata of the ovary and explained them as unruptured Graafian follicles. They occur more frequently with fibroids of the uterus than with any other pelvic lesion.

As to age, cysts and other tumors of the ovary occur now and then in girls and they have been reported even in infants; also, they

are found in those past middle life and among the aged; but probably about ninety per cent of them occur during the period of sexual activity, that is, from twenty to forty-five or fifty.

III. *Regressive changes.* Although about twenty per cent of all ovarian tumors are malignant and although hæmorrhages from this cause are not uncommon, yet they are usually small and inconsequential.

IV. *Trauma.* Now and then cases of rupture and hæmorrhage, one or both, are reported due to such accidents as falling from a stepladder (Le Conte), striking against a chair, etc. Dr W. E. Morgan, of Chicago, has related to me in personal conversation a case in which he ruptured a cyst while making a bimanual examination. There was no ill result to the patient, in fact, as far as he ever was able to ascertain, the cyst never reformed.

V. *Sudden reduction of intracystic tension.* This is caused most frequently by rupture or puncture of the cyst or by lessening of intra-abdominal tension through delivery of a baby. In this category comes the case described at the beginning of this article. Fig 2 is a diagram illustrating the mechanism in this case, a, b, c, d, e, represents the outline of the tumor when compressed by the gravid uterus. When the latter was emptied, the side a b c, being relieved from this pressure, moved in the direction indicated by the arrow, assuming the position a b c, thus greatly increasing the intracystic capacity and correspondingly lowering the intracystic tension. The walls of one or more veins gave way and thus the hæmorrhage occurred.

VI. *Increased blood pressure.* Mere raising of the pressure of the blood alone is more a theoretical than an actually demonstrable cause.

VII. *Inflammation.* This is a comparatively rare cause, as far as the writer is able to ascertain.

*Histogenesis of ovarian cysts.* They arise usually either from the parovarium or from the ovary itself. The origin of ovarian cystadenomata (like the author's case) is a much discussed question. According to the researches of Clark and others, cysts of this latter type spring from the remains of the

secreting tubules of the Wolffian body left imbedded in the base of the ovary. The evidence in favor of this theory seems to be very conclusive indeed. However, it is too far from the object of this article to go into details concerning this subject; therefore, I will reserve for a future paper a description of my investigations along this line.

#### PATHOLOGICAL ANATOMY

This has been described to a large extent under etiology. Further facts ought to be stated as follows.

1 *Circulatory changes* (Edematous swelling is encountered very frequently, as a result of either twisted pedicle or inflammation. The color in this condition ranges all the way from red to dark blue, the latter predominating. The shape of the cyst is spheroidal and the consistency rather soft, unless the fluid is under great tension, in which case the cyst is hard to the touch.

2 *Inflammation* A mild pericystic inflammation producing adhesions to the surrounding structures is a practically constant finding. Purulent inflammation within the cyst is not uncommon, but primary hemorrhagic and gangrenous inflammations are rare.

3 *Regressive changes* Ovarian tumors have been known to decrease in size spontaneously (Williams); but this change is rare. The most common finding along this line is gangrene, due usually to torsion of the pedicle. According to T. J. Watkins, however, gangrene never supervenes after torsion without bacterial infection. He says, "If there are no bacteria we get no gangrene simply atrophy." The color of the gangrenous cyst is black or bluish black. Of course, with inflammation, we find all of the regressive changes which occur usually with that process. Cases of malignant degeneration are common, constituting probably about twenty per cent of all ovarian tumors. Hemorrhage of clinical significance in them, however, is rare.

4 *Progressive changes* Nearly all ovarian tumors, especially cysts, have a tendency sooner or later to increase in size—they are decidedly neoplastic in their nature. Shenck, Williams, Spencer and most other writers

maintain that pregnancy does not cause an ovarian tumor to increase rapidly in size. As to the effect of pregnancy in causing malignant degeneration, there is a division of opinion. Lohlein and Olshausen (both quoted by Shenck) and Wernich and Leopold (both quoted by Williams) believe that pregnancy does predispose very markedly to malignant degeneration. Williams, however, holds the opposite view, basing his conclusions in a very logical manner upon a large number of collected cases and a rich personal experience.

Mere increase in size may be due to edema, hemorrhage, inflammation, simple growth or malignant growth, each alone or in combination with one or more of the others.

#### TREATMENT

The following table (p. 71) gives in a concise manner the results of the various methods of treating ovarian tumors.

As a summary of this table, we find that obstetrical operations (usually without previous removal of the tumor) have the highest mortality of any method of procedure, namely thirty-nine per cent; tapping has twenty-nine per cent; expectant treatment, twenty-five per cent, while ovariectomy has only four and seven tenths per cent. These figures taken together with the fact that the fetal mortality is probably lower (at least not higher) in ovariectomy than in the other methods, tell their own story.

The publications on which the above statistics are based all appeared during the last fifteen years. The oldest one is that of Williams 1897.

According to Dsrine, in 1892, the high mortality of ovariectomy in earlier days had been reduced to about six per cent.

It must be noted that the mortality of four and seven tenths per cent for ovariectomy given above includes *complicated* cases. In simple cases (during pregnancy) McKerron in 1903 gave the mortality as about two per cent. At present, it probably is less than one per cent.

Ovariectomy then is the treatment par excellence for ovarian tumors, no matter what their relation to pregnancy (one exception to be mentioned later); for this method

## TREATMENT OF OVARIAN CYSTS

Kind of Treatment	Relation to Pregnancy	Per-centage Maternal Mortal-ity	Percentage Inter-rupted Pregnancy or Child Mortality	Authority	No. of Cases			
EXPECTANT	During pregnancy, labor and puer-perium	21	30	McKerron	720			
	Before labor	26	19	Patton	95			
	Post partum	28	Not stated	McKerron	Not stated			
	<i>Average mortality</i>	25	19					
TAPPING OR PUNCTURE	Before labor	39	59	Patton	31			
	During labor	29	18	Marshall	56			
	During pregnancy, labor and puer-perium	26	Not stated	Williams	Not stated			
		23.5	30	McKerron	51			
		Not stated	45	"	75			
	<i>Average mortality</i>	29	43					
OBSTETRICAL OPERATIONS— "Artificial delivery"	Without previous removal of tumor	During Labor	49	Not stated	McKerron	49		
			26	"	Williams	Not stated		
			26	"	"	"		
			44	"	"	"		
			90	"	"	"		
			8	"	Lea	12		
			80	"	McKerron	10		
			12	"	"	41		
			15	13	Marshall	61		
			39					
			0	Not stated	McKerron	3		
			Kind of ovariectomy not stated	During labor	10	"	Williams	Not stated
					0	17	Marshall	16
	0	Not stated			McKerron	15		
43	19	Patton			184			
Abdominal "Operations" . . .	During puerperium	14	Not stated	McKerron	92			
	<i>Average mortality</i>	4.7	18					

has a mortality far below that of any other kind of treatment.

It is interesting to note how formerly this operation had a very high mortality. For example, 1,000 cases of ovariectomy performed by Wells, from 1858-1880, gave a mortality of twenty-two and five-tenths per cent. Nevertheless, about 1877, this became an established method of treatment, due more to the efforts of Wells than to those of any other man.

Cæsarean section does not have a fair show in the preceding table. With modern technique and undertaken early, it is one of the very best methods to apply in connection with certain ovarian cysts complicating pregnancy at or near term.

It is indicated especially in two classes of cases; first, in those where the tumor is impacted in the pelvis and can not be dislodged by ovariectomy; secondly, in instances where, though the tumor has been removed, there is doubt as to the facility with which the child can be delivered per vias naturales.

Forceps, version and craniotomy are particularly deadly procedures if undertaken without previous removal of the tumor. Version especially is to be avoided.

"Tapping should be employed," McKerron very rightly maintains, "only to relieve symptoms *due to distention*" or as a temporary measure to facilitate delivery, if the cyst is impacted in the pelvis and is preventing the descent of the child. Furthermore, tapping or reposition may be resorted to usually only on condition that the tumor be extirpated within twenty-four hours (never more than one to two weeks) after delivery. The patient in no case should be advised to wait a long time, say till the baby is weaned, before she has the tumor removed. Statistics show that such a delay is altogether too hazardous, giving a far higher mortality than early ovariectomy.

As to expectant treatment, Schenck, Barrett and many others think that it has no place in handling ovarian cysts. They hold that operation is indicated at once, whenever an ovarian tumor is discovered, provided, of course, that there are no contra-indications to a major operation. This attitude, which is

prevalent especially in America, should be modified, I think, by the fact universally accepted that interruption of pregnancy from operation is much more likely to occur during the latter half than during the first half of pregnancy. Hence, Spencer and other English authorities advise waiting at least till the child is viable before operating, if the tumor is not discovered till after the fifth or the sixth month, unless, of course, the condition of the mother is urgent. By following this course, very likely the percentage of interruptions of pregnancy will be reduced without materially increasing the maternal mortality.

Small tumors of the ovary should never be treated expectantly because of their diminutiveness, for these are just as apt to give trouble as the larger ones.

#### SUMMARY

1 *Etiology and pathology.* Ovarian cysts almost always produce serious trouble sooner or later and especially during pregnancy, labor, and the puerperium. The most dangerous period is the puerperium. Torsion of the pedicle is the most common accident with its resultant hæmorrhage, gangrene, and infection. The most frequent result of twisted pedicle is hæmorrhage, which occurs in about fifty per cent of all cases of torsion. Hæmorrhage from all causes occurs in about twelve per cent of all ovarian tumors, in both the pregnant and the nonpregnant, nine per cent in the former and about three per cent in the latter. Though the multilocular cystadenoma is the most common cyst of the ovary yet dermoids seem to produce serious trouble proportionately more frequently.

2 *Treatment.* The tendency of ovarian tumors is almost always to increase in size more or less and also sooner or later to undergo torsion, hæmorrhage, gangrene, infection or malignant degeneration. Hence in general, these cysts should be removed as soon as possible after they are discovered. One should usually be particularly careful not to let a woman pass into the puerperium without first ridding her of the cyst.

Most clinicians maintain that an ovarian tumor in most cases should be removed as soon as it is found. Exception may be made

to this rule in case the tumor is not discovered till after the fifth or the sixth month of pregnancy. One then frequently is justified in waiting till the child is viable.

As to the choice of treatment, there usually is no room for doubt. So-called expectant treatment in most cases amounts to practically no treatment at all. Aspiration has a very high mortality. Obstetrical operations have an enormous mortality, unless the obstructing tumor is removed before they are undertaken. Ovariectomy (usually abdominal) has a mortality far less than any other procedure (less than five per cent of all cases). Cesarean section, if undertaken early, is an excellent procedure in certain cases. I can conclude best with the words of McKerron, which are more pertinent today than they were nearly ten years ago when he wrote them: "All the available evidence points to the advisability of early operation" (ovariotomy).

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## MECKEL'S DIVERTICULUM

### WITH REPORT OF FOUR CASES

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IN 1812, John Frederick Meckel first accurately described the diverticulum which now bears his name, although its existence had been referred to in medical literature many years earlier.

While this abnormality is present in only about two per cent of the human race, it is of considerable surgical interest on account of the great variety of pathological lesions to which it may give rise and the impossibility of diagnosing its presence as the causative factor

In order to fully understand the pathology of this condition, we must turn to the study of fetal development. Embryologists tell us that in the beginning of fetal life the middle portion of the primitive gut, or the mid-gut, is connected to the yolk sac by a wide canal, called the vitelline duct This duct

is accompanied by an artery and two veins, which maintain the circulation between the yolk sac and the intestine. At the end of a few weeks, this vitelline duct becomes functionless, and under normal condition entirely disappears, the atrophy beginning at the distal end The vessels disappear at the same time, except that portion in the mesentery, which persists and eventually forms the superior mesenteric artery and vein.

In two per cent of human beings this atrophy is not complete, and varying portions of this duct may remain, and it is this remnant of fetal life which is known as Meckel's diverticulum. Likewise the vessels, although functionless, may persist as a cord running from the end of the diverticulum to the umbilicus, or its distal end may be attached to the abdominal wall, the mesentery or any

other organ, or its end may be free. It is this cord that is so frequently the offending agent in the production of obstruction.

The diverticulum may be found in any part of the jejunum or ileum, but in most cases in the last two or three feet of the ileum.

Diverticula of the duodenum are of an entirely different origin, as this part of the intestine does not develop from the mid-gut. Its point of attachment to the ileum is nearly always opposite the mesentery, although occasionally it may be lateral or even close to the mesentery.

Its opening into the bowel is usually equal in size to the lumen of the bowel itself, but it is sometimes restricted by a valve-like projection of mucous membrane. Although somewhat thinner, its structure is similar to the intestine, even to the existence of Peyer's patches.

The diverticulum may have a mesentery of its own attached to that of the bowel from which it arises. It is believed that this mesentery may undergo atrophy, leaving only a fibrous band, which accounts for the frequency with which a cord is found extending from the side of the diverticulum to the root of the mesentery.

In shape it is usually conical, although this is by no means constant, as it may be found bulbous, hammer-shaped or even spherical from a constriction of its base.

As a rule, its length varies from a mere projection to six or eight inches, and a case of Pollard's is cited by Turner where it was thirty-six inches long. The average length is about two or three inches.

Its location in the abdomen naturally varies, depending upon its point of origin and the mobility of the ileum, but in most cases it is found in the right side, which accounts for the frequency with which lesions of this structure are confused with appendicitis.

For some reason which it is impossible to explain, Meckel's diverticulum is more common in males than females in about a ratio of three to one. The diagnosis of the presence of this structure either in health or disease is absolutely impossible, except in those cases where it remains patulous at the umbilicus.

When it is present, its existence is believed

by Fitz to be a greater menace to its possessor than an appendix, on account of the very serious lesions to which it may give rise.

The relative infrequency of the occurrence of disease of Meckel's diverticulum is shown in figures of Balfour (2), who reports fifteen cases in 10,600 abdominal operations in the Mayo clinic, and in only five of these was it the cause of the operation. In the other ten cases, the diverticulum was found in the course of operation for other conditions and was removed. In a few of these, pathological changes were noted.

It is undoubtedly advisable to remove a Meckel's diverticulum whenever found, unless the exigencies of the case absolutely prevent. In its removal, if the base is small, a purse-string suture may be used, as with the appendix, but more frequently it will be necessary to employ rows of Lembert sutures, or even to resect the intestine to prevent constriction.

The following four cases have come under my care, all between the years 1907 and 1910:

CASE 1. White man, age 50, seen on May 11, 1907, in consultation with Dr. Firschhorn. He gave a history of an acute abdominal crisis of two days' duration, with abdominal pain, persistent vomiting, constipation and some distention. The rigidity was more noticeable over the right rectus. A diagnosis of probable appendicitis with paralytic ileus was made. The leucocytes were 7,400. Operation revealed a loop of bowel about one foot long, distended and deeply injected, which was constricted by a Meckel's diverticulum from the tip of which was a cord running to the umbilicus. The diverticulum was removed, and the stump inverted. There was considerable free fluid in the abdomen. It was thought that a resection was unnecessary, and the abdomen was closed with drainage. A few days later he developed a fecal fistula. Although his bowels moved freely and there was no evidence of obstruction, his condition gradually grew worse and he died sixteen days after the operation.

CASE 2. White boy, aged 7, was brought to Children's Hospital November 23, 1908, with a history that since birth there had been a discharge of mucus from the umbilicus. The mother stated that when boy was six weeks old, there had been a sloughing of the entire navel. Upon admission there was a slight discharge of mucus and a very small probe showed a fistula through the abdominal wall. A median incision was made, dissecting out the umbilicus and the fistulous tract. It was then found that it connected with a small patulous cord running to the tip of a Meckel's diverticulum. This latter process was about one inch long and

attached to the ileum opposite the mesentery. The diverticulum was removed, and the opening turned in by a purse-string suture. He made a good recovery.

**CASE 3** White male, age 38, admitted to George Washington Hospital on March 5, 1909, to the service of Dr. Rufin. He gave a history of having had cramps in abdomen for the past three weeks. Three days before admission, he had a chill followed by several vomiting attacks. During the first three days in the hospital, his temperature did not go above 100°, pulse normal, leucocytes 16,000. He had some abdominal pain, and there was a distinct right rectus rigidity. A diagnosis of appendicitis was made. Operation revealed a normal appendix but a gangrenous Meckel's diverticulum about one foot above ileo-caecal valve. There was some localized peritonitis. The diverticulum was removed, the stump turned in and the abdomen closed with drainage. The diverticulum in this case was about three inches long, with a free end. Although this patient's bowels moved freely and there was very little distention, he began vomiting shortly after the operation and this persisted until his death, three days later.

**CASE 4** White male, age 55, a patient of Dr. Rufin's, was first seen by him on July 8, 1910. He gave a history of having had great pain in right side of abdomen near the umbilicus for past thirty-six hours. He was sent to George Washington Hospital, where I first saw him at six P. M. of the same day. His temperature was 99.4, pulse 90, leucocytes 16,500, urine normal. He had marked rigidity and tenderness just to the right of the umbilicus. There was no nausea or vomiting. This was thought to be probably an appendicitis, although the location of the pain and tenderness should have been suggestive of diverticulitis. An incision was made through the right rectus on a level with the navel. Upon separating a mass of omental adhesions an acutely inflamed Meckel's diverticulum about two and one half inches long and nearly the diameter of the small bowel was disclosed. One point near the base seemed about to perforate. The diverticulum was removed and the hole in the bowel was closed with two rows of Lembert sutures. The appendix, which had become slightly inflamed from continuity was removed. The abdomen was closed with drainage. This patient made a slow but good recovery. Upon examining the specimen, it was found to contain the breast bone of a small fowl, one prong of which had nearly perforated. When questioned later, he remembered that while eating a squab two weeks previously, he had realized that he had swallowed a piece of bone, but had given it no more thought.

In a fairly careful search of the literature I have been able to collect 326 cases of disease, involving Meckel's diverticulum. This does not include cases recorded where it was found post-mortem or in the course of other

operations, and was not itself involved. One can better realize the great variety of abdominal crises to which this process may give rise, by observing the pathological lesions found in these 326 cases.

There were 144 cases of intestinal obstruction (intussusception and volvulus not included); 59 of intussusception; 50 of acute diverticulitis; 27 of hernia; 21 in which the diverticulum was open at the umbilicus; 9 of volvulus; 6 of perforation in typhoid; 2 of perforation from trauma; 2 of tubercular ulceration; 3 of prolapse of bowel; and 1 each of pelvic tumor, perforating ulcer, and cyst.

Of these cases, 201 were males and 64 females and in 61 the sex was not given. The ratio of males to females was a little more than 3 to 1. Of the 326 cases, 175 died, 129 recovered and in 21 the result was not stated.

To consider the statistics in detail, we find there were 144, or 44 per cent, of intestinal obstruction. Halstead (3) estimates that 6 per cent of all cases of obstruction are due to a Meckel's diverticulum. Eisendrath (4) has very well discussed the mechanism by which obstruction is brought about. Suffice it to say that in most cases, it is due to the presence of a cord extending from the tip of the diverticulum to its attachment upon some other part of the abdomen. In about one third of the cases, this cord when present is attached to the umbilicus. In quite a percentage of cases, it is attached to the mesentery and abdominal wall and less frequently to other structures. It is supposed that this cord in some way becomes freed from the umbilicus and then by inflammation or otherwise becomes fixed to other parts. Gilbert (5) reports a case dying from obstruction without operation, in which, at autopsy, this cord was found to have encircled the bowel one and one half times through a hole in the mesentery.

Of the 144 cases of obstruction, 108 were operated with 50 deaths and 52 recoveries, and in 6 the result was not stated. Of the 28 cases not operated upon, all died. The treatment in the other 8 cases is not mentioned. The operation consisted of a resection of the bowel in 11 cases, with 7 deaths and 4 recoveries, of a removal of the diver-

ticulum in 52 cases, with 17 deaths and 33 recoveries, and in 2 the result is not stated; in 22 cases, the offending band was simply cut, resulting in 9 deaths and 11 recoveries, and in 2 the result is not given; in 3 an entero-enterostomy was done with two deaths and one recovery; in one fatal case the bowel was stitched to the abdominal wall.

Intussusception is comparatively common, occurring 59 times in this series. It can be readily understood, that, given a comparatively short, conical diverticulum without attachment, it might easily become inverted and act as a polypus in causing an intussusception. The youngest case was five months, and the oldest sixty years, and while intussusception under ordinary conditions occurs in a large proportion of cases during the first two years, only ten per cent in this series occurred during that period. The average age of the intussusception cases was 14 years. Turner (1) reports an interesting case of a male child sixteen months old operated upon by Mr. Lane, who found an intussusception in the right iliac region; this was reduced and a second found, this was reduced and found to contain a third, and the last contained an inverted diverticulum. Of the 59 cases, 44 were operated upon with 24 deaths and 20 recoveries. Fourteen cases were not operated upon, with nine deaths, one recovery from sloughing of the intussusceptum, and in four the result was not stated. The treatment in one case was not mentioned.

Diverticulitis symptomatically and pathologically closely resembles appendicitis, for which in nearly every instance it was mistaken. Among the fifty cases, there were all degrees of severity from the mild catarrhal to the gangrenous with general peritonitis. Most of the cases were acute, and chronic diverticulitis would appear to be less common relatively than chronic appendicitis. Because of the large opening into the intestine, a diverticulum is more liable to be the lodging place of foreign bodies than is the appendix, and these were the exciting cause in fifteen of these cases. Nearly every foreign body that could gain entrance to the intestines has been found. Enteroliths, gallstones, seeds, pins, bones, etc., have been

noted. Peck (6) reports a case with symptoms of partial obstruction and at operation a Murphy button, which had been employed three years previously in a gastro-enterostomy, was found just below a Meckel's diverticulum. Peck believes that the button had been lodged in the diverticulum and had just passed into the bowel, giving rise to symptoms for the first time. While the large opening renders a diverticulum more liable to the lodgment of foreign bodies, at the same time it offers a free exit for the secretion and this is undoubtedly a prominent factor in explaining the infrequency of diverticulitis as compared with appendicitis.

The mortality in acute diverticulitis is forty per cent. This high death rate compared to that in appendicitis is probably due to the greater liability to early perforation, the frequent involvement of the bowel, the greater mechanical difficulty in its removal, and the less tendency to localization of the infection.

The 21 cases of persistent umbilical fistula presented all degrees from minute opening with a slight mucous discharge to those in which the whole intestinal contents were emptied through the umbilicus. It is frequently associated with a polypoid growth or there may be a prolapse of the mucous membrane of the diverticulum. Many of the milder cases are probably never diagnosed, as they may heal spontaneously or by the use of the actual cautery. The congenital faecal fistulae are undoubtedly due to a Meckel's diverticulum emptying into the umbilical cord, or even protruding into the cord and being ligated with it, the diagnosis not being apparent until the separation of the cord takes place. Of these 21 cases, 16 were operated upon with only 1 death. The treatment in 5 cases was not mentioned.

There were 27 cases in which a Meckel's diverticulum formed a part of the contents of a hernia. Of these, 12 were inguinal, 10 umbilical, 2 femoral, 2 scrotal and one not stated. Many of these were strangulated and in a few the diverticulum alone was found at operation.

Nine cases of volvulus were found. It can be readily understood how a long diverticulum starting from the side of the small in-

attached to the ileum opposite the mesentery. The diverticulum was removed, and the opening turned in by a purse-string suture. He made a good recovery.

**CASE 3** White male, age 58, admitted to George Washington Hospital on March 5, 1909, to the service of Dr. Rufin. He gave a history of having had cramps in abdomen for the past three weeks. Three days before admission, he had a chill followed by several vomiting attacks. During the first three days in the hospital, his temperature did not go above 100°, pulse normal, leucocytes 16,000. He had some abdominal pain, and there was a distinct right rectus rigidity. A diagnosis of appendicitis was made. Operation revealed a normal appendix but a gangrenous Meckel's diverticulum about one foot above ileo-caecal valve. There was some localized peritonitis. The diverticulum was removed, the stump turned in and the abdomen closed with drainage. The diverticulum in this case was about three inches long, with a free end. Although this patient's bowels moved freely and there was very little distention, he began vomiting shortly after the operation and this persisted until his death, three days later.

**CASE 4** White male, age 55, a patient of Dr. Rufin's was first seen by him on July 8, 1910. He gave a history of having had great pain in right side of abdomen near the umbilicus for past thirty six hours. He was sent to George Washington Hospital, where I first saw him at six P. M. of the same day. His temperature was 99.4, pulse 90, leucocytes 16,500, urine normal. He had marked rigidity and tenderness just to the right of the umbilicus. There was no nausea or vomiting. This was thought to be probably an appendicitis, although the location of the pain and tenderness should have been suggestive of diverticulitis. An incision was made through the right rectus on a level with the navel. Upon separating a mass of omental adhesions an acutely inflamed Meckel's diverticulum about two and one half inches long and nearly the diameter of the small bowel was disclosed. One point near the base seemed about to perforate. The diverticulum was removed and the hole in the bowel was closed with two rows of Lambert sutures. The appendix, which had become slightly inflamed from continuity, was removed. The abdomen was closed with drainage. This patient made a slow but good recovery. Upon examining the specimen, it was found to contain the breast bone of a small fowl, one prong of which had nearly perforated. When questioned later, he remembered that while eating a squab two weeks previously, he had realized that he had swallowed a piece of bone, but had given it no more thought.

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# DEPARTMENT OF TECHNIQUE

## A CASE OF CARCINOMA OF THE BLADDER CONTROLLED BY THE HIGH FREQUENCY CURRENT

By EDWARD L. KEYES, Jr., M. D., NEW YORK CITY

IN spite of all that modern surgery has done toward radical removal of malignant growths, in spite of the many lasting cures that have undoubtedly been achieved, the general public continue to believe these tumors incurable by any operation. Such an attitude is both unwarranted and reprehensible. Yet it is founded upon the observation of many post-operative recurrences of cancer, each one of which leaves a terrible impression upon the imagination of the sufferer's friends and relatives, an impression not to be effaced by any number of cures.

But before we reprehend too sharply the uninformed layman whose ignorance as to the surgical cure of cancer often encourages that delay which is the very source of our failures, we should perhaps clear up our own theories a bit. For we, too, may be misled as to the malignancy of carcinomatous growths and from the very same observation of post-operative recurrences that forms a basis for the skepticism of the layman, we may conclude not only the truth that successful surgery requires earlier diagnosis of malignant growths, but also the falsehood that wide surgical removal of the growth with the surrounding apparently healthy tissue is the *only* cure for *any* carcinoma.

We must face the facts, we must recognize that what the curette and arsenic have done for certain malignant neoplasms of the skin, radium and the X-ray are doing for more malignant growths in accessible situations. Indeed, while we still await the specific poison for carcinoma that shall replace cautery and knife alike, we must open our ears to the claims of each of these, and recognize that the great superiority of the knife lies in its ability to reach the depths diseased, while the various cauterizing agencies are efficient only in the treatment of superficial and accessible lesions.

Now, to turn from the general to the particular, bladder growths have only recently been made accessible to cauterization through modern opera-

tive improvements in cystoscopic technique, of which the most important is the application of the Oudin current according to the method of Beer. We have learned that this treatment is well qualified to compete with the knife in the treatment of benign papilloma of the bladder, but how far it may be depended upon to treat beginning papillary carcinoma—that condition which in its incipency is confusing to pathologist and surgeon alike—we do not yet know. As an item in the determination of this question I submit the following case, the first phases of which have been previously reported.

The patient, a stout, sedentary man, 61 years of age, consulted me first on July 30, 1909. He gave a history of glycosuria and constant marked arterial tension (200 or over) for several years previously. Two months before seeing me he first noticed a spontaneous, profuse, total hematuria and since that time he had seen blood in his urine almost every day. I cystoscoped him and found a small villous growth just back of the right ureter.

On October 2d I removed this growth through a suprapubic opening, cutting it away with an elliptical area of apparently normal mucosa about its base. Except for a post-operative pneumonia, which nearly carried him off, convalescence was uneventful, but the specimen, submitted to pathological examination, showed carcinomatous infiltration up to the cut edge of the apparently normal mucosa (Figure 1).

November 20, 1909. Three and a half months having intervened since the operation, I cystoscoped the patient in the presence of Dr. Van Riempt, and saw a small papillary growth at the scar. This I burned with the D'Arsonval current.

March 12, 1910. In the presence of Dr. Beer and Dr. Barringer I again burned with D'Arsonval current. The tumor on this occasion looked about as it had four months before.

On April 2, 1910, and April 23, 1910, I again burned with the D'Arsonval current.

May 14th. The original tumor had disappeared, but three small villous tufts were seen upon the vault of the bladder; two of these I burned with the Oudin current.

October 15th. A fifth recurrence in the shape of a small villous growth in the roof of the prostatic urethra was burned through the urethroscope with the Oudin current.

January 7, 1911. In the presence of Drs. Cabot, Smith Connors, and Barringer I burned with the Oudin current the third tumor in the vault of the bladder, which had not

yet been burned, and also the tumor at the ureteral orifice, which had been burned once previously.

January 28th Both these tumors were burned again. October 26th Cystoscopy showed no trace of any of the four tumors within the bladder, but a small villous growth within the urethra. This was burned with the Oudin current.

Meanwhile the patient had undergone various vicissitudes, mentally and physically, due to his high blood pressure and sugar.

On December 11, 1911, he died of acute dilatation of the heart. No autopsy.

The history of this case may be summed up as follows:

A small papillary growth was removed from the bladder and proven carcinomatous by pathological examination. It recurred, as was to be expected, but was apparently cured by four burns with the D'Arsonval current, and is known not to have relapsed from April 23, 1910, to October 26, 1911.

In the meanwhile four other growths of similar character appeared. These were all burned with the Oudin current. Two of them were cured by a single burn on May 14, 1910, one by two burns in January, 1911, and the cures were cystoscopically verified on October 26, 1911. The fifth tumor was burned four times and the patient was not cystoscoped after the last burn.

Thus we have a known carcinoma apparently cured for eighteen months, two recurrences in other parts of the bladder cured 17 months, one cured 9 months and one of which the cure was not verified.

I may add that, inasmuch as the patient continued to gain weight from the time of his operation up to the time of his death, it is to be presumed that there were no carcinomatous metastases.

Although so brief a history, unfortified by post-mortem examination, can give us no certainty that the tumor was cured, it is nevertheless striking evidence of complete control of a small carcinoma for a considerable number of months, and while my own experience does not offer any comparable case, I have in two or three instances, by means of the high frequency current, cleared the bladder of tumors whose hardness, as determined by contact with the ureter catheter and the electric wire, was very suggestive of malignancy; moreover I am now treating a patient, 80 years of age, who after more than two years of more or less interrupted burning of his bladder tumor, exhibits an irregularly infiltrated area from which great masses of papillomatous tissue have been burned away. He is no longer distressed by the hæmaturia from which he suffered for eight years, before these tumors were burned,

and his general condition is excellent. No doubt such a tumor must be malignant, yet not only are we holding it in check, but, on the whole, we are rather getting the better of it.<sup>1</sup>

On the other hand, every one who has experimented with this method of treating bladder tumors must be impressed by certain clinical characteristics whereby the tumors intractable to cauterization may be distinguished from those likely to yield to it.

Let us put aside for a moment the arid discussion of what is and what is not true carcinoma, and discuss in terms of therapeutics what is and what is not the tumor amenable to intravesical cauterization—the malignant tumor in the true sense of the word. The discussion is an ancient one. The reiteration of its details would not interest you. But the struggle of the pathologists to discover an incipient carcinomatous focus that may lie hidden in an excised papilloma is no longer the chief point at issue. The clinical question is now the more important, and we must attempt to determine the limitations of intravesical cauterization, so as to be prepared, not only to treat in this manner as many patients as possible, but also to avoid disastrous delay from neglect of radical surgery in favor of futile burning.

My own experience has furnished four clinical points:

1. Hardness of the tumors.
2. Multiplicity and size of tumors
3. Sloughing of the surface of tumors
4. Intractable cystitis.

*Hardness of Tumors* After a little experience one readily recognizes in certain tumors the existence of a hard, more or less pedunculated mass against which the electric wire strikes as it passes among the villi. Such tumors are relatively resistant to burning, yet, as stated above, some of them can certainly be controlled by this method. I have not had the opportunity of burning the small hard infiltrated ulcer, so characteristic of carcinoma. In papillary tumors induration of the base can scarcely be determined by cystoscopy, but a tumor whose indurated base can be felt by rectal touch is incurable by burning.

*Size and Multiplicity of Tumors.*—Several tumors, so large that their size could not be accurately estimated by cystoscopy, have been successfully destroyed by burning, and in several instances multiple tumors have been burned away. I have not seen any case in which size

<sup>1</sup> I noted the last time I cystoscoped him, six weeks after this was written that every trace of the tumor had disappeared.



Fig 1 Section from apparently normal mucosa. The carcinomatous infiltration occupies the very bottom of the picture

and multiplicity were decisive elements in deciding against local treatment and in favor of operation. Yet the larger and more numerous the

growths, the more likely are we to find, when we have burned them away, an infiltrated base which forbids the hope of cure by burning.

*Sloughing Surface of Tumors* — Small hemorrhagic and sloughing spots upon the surface of an otherwise villous tumor do not necessarily indicate malignancy, but I have never yet been in the least successful in burning any tumor covered with an extensive sloughing area.

*Intractable Cystitis* — The most striking contra-indication to cauterization, however, is severe intractable cystitis. It is, of course, not impossible that the most benign papilloma should be complicated by severe cystitis. Yet it has been my experience that cystitis, occurring in the presence of a bladder growth curable by cauterization, is itself more or less readily relieved by irrigation of the bladder, while acute cystitis, causing intense frequency and pain on urination, contra-indicates cauterization, not only because of the pain excited by every cystoscopy, but also in virtue of the fact that the tumors in such cases do not appear to yield to this treatment.

Such are the features indicative of clinical malignancy which the cauterization of bladder tumors has yielded to my observation up to the present time.

## CLAWFOOT, AND HOW TO RELIEVE IT

By A. MACKENZIE FORBES, M. D. C. M., MONTREAL

Surgeon in charge Children's Memorial Hospital. Surgeon in charge Orthopaedics, Montreal General Hospital, Lecturer on Orthopaedic Surgery, McGill University.

**T**HERE is a common deformity of the foot which is not usually described in text books, which some have called "clawfoot," and which others have called pes cavus, and by a variety of names.

This deformity is characterized by a fore shortening of the foot with contraction of the plantar fascia, causing cavus, by a tonic contraction or permanent shortening of the extensor muscles and tendons, causing hyperextension or perhaps even dorsal subluxation of the toes, which contraction causes, or is accompanied by, a depression of the metatarsal heads, much as is seen in anterior metatarsalgia. These depressed heads, by impinging on the soft tissues of the sole of the foot, cause discomfort, callosities, and sometimes even pain of so severe a nature that walking may be rendered difficult or impossible.

This condition is often confounded with clubfoot. It differs from it, however, in two ways. First, "clawfoot" is not characterized by marked varus, which is the characteristic deformity of clubfoot. Second, "clawfoot" is never congenital, whereas clubfoot is often, or I might say nearly always, a congenital deformity. The onset of "clawfoot" is insidious and so is its development. The tendency to this deformity may be noticed shortly after birth, but the complete deformity—the foreshortened foot with cavus and hyperextension of the toes—is rarely, in my experience never, noted at the time of birth.

It is interesting to study radiograms of feet of those suffering from this deformity. The hyperextension of the toes, the tendency to dorsal subluxation, and the increased arch already spoken of are all demonstrated.

The cause of this deformity is not generally





Fig 1. Skigram of foot of patient who is suffering from "clawfoot." This demonstrates that the first metatarsal bone in this patient is depressed anteriorly and that the proximal phalanx articulates principally with the dorsal surface of this bone. The foot is seen to be fore-shortened.

known. Some say that it is due to anterior poliomyelitis. Others say that it is due to the shortening of the plantar fascia, again others say that it is due to a shortening of the extensor muscles, and others, to a paralysis of the peronei. Which theory is right? I am inclined to the view that in some cases this deformity may be due to one of these causes, often it may be due to a combination of these, and perhaps sometimes it is due to abuse of the foot by wearing misfitting boots.

The treatment of this condition is worthy of consideration. Many operations have been devised for its relief. Included amongst these are plantar fasciotomy, subcutaneous division of the extensor tendons, wrenching, and perhaps most radical of all is the operation which I believe is used by Mr Robert Jones of Liverpool in intractable cases, viz, the excision of each metatarsal head and the astragalus.

Two years ago, at a meeting of the American Orthopaedic Association, I suggested that the most rational operation for the relief of this condition was an operation similar to that devised by me for the relief of anterior metatarsalgia. Since then I have made use of this method with such pleasing results, that I take this opportunity of drawing the attention of general surgeons to it.

My procedure has been to transplant the common extensor tendons into the heads of the metatarsal bones, after having detached them from their insertions into the phalanges. This is done in the belief that the common extensors, while maintaining the phalanges in a position of

hyperextension, are acting as a power for positive evil. It is done also to furnish a means of support for the depressed heads of the metatarsal bones. Surely if the common extensor is strong enough to be responsible, or even partly responsible, for such position of deformity as is demonstrated by the position of the phalanges in the accompanying radiograms, it ought to be a valuable aid in maintaining the depressed metatarsal heads in a position nearer to the normal. I think, then, that we can thus transplant the common extensor and the extensor longus hallucis in perfect confidence that the extensor brevis pollicis will prove to be strong enough to maintain the toes in a position midway between extension and flexion.

The operation is a difficult one, because the periosteum of the middle metatarsal is not strong enough to be made use of as anchorage for the transplanted tendons, and because they are so deeply placed that it is often difficult to get anchorage by drilling through the necks of these bones, but by strong pressure exerted beneath, we may so raise these that, if we cannot bore transversely through the necks we can at least bore obliquely from each side to a common place of meeting, or, again, we may manage to insinuate a silk ligature around the metatarsal. This can be best done after the method adopted by B. E. MacKenzie of Toronto in various tendon transplantations. The principle of this is to carry the ligature from the dorsal to the plantar surface of the foot by means of a needle, which is made to hug the neck of the metatarsal bone. This ligature is then returned from the plantar to the dorsal surface of the foot by inserting the threaded



Fig. 2 Skiagram of patient No. 1 taken three weeks after the operation. This demonstrates the lengthening of the foot by the transplantation of the extensor pollicis in the manner described in the text. This demonstrates also that an osteotomy has been performed near the base of the first metatarsal bone. Marked improvement has resulted.

needle into the same perforation of the plantar skin as that through which it made its exit. It is then made to hug the opposite side of the metatarsal bone, and is drawn out of almost the same spot as that on the dorsal surface into which it was originally thrust. This scheme has the disadvantage of constricting the soft parts of the plantar surface and of leaving the skin of that surface puckered in much the same way as is done by the mattress maker.

The operation which I bring to your notice is performed through a horseshoe shaped incision on the dorsal surface of the foot. This incision is, however, preceded by a subcutaneous plantar fasciotomy, with wrenching if necessary. The incision is carried to the extensor tendons, and a flap containing all the tissues superficial to these is turned back onto the dorsal surface of the tarsometatarsal articulation. The long extensor tendons are then detached from the phalanges and transplanted into the necks of the metatarsals in either of the methods suggested. The silk

attachments are then buried as deeply as possible by means of fine catgut sutures, and the skin flap returned and sewed into place by means of horsehair.

This operation should be sufficient to relieve the majority of patients suffering from this deformity, but if, on our first examination of the patient, it is felt that the arch of the foot has been so greatly increased that the transplantation of the extensors cannot be expected to undo the damage done, by possibly years of malposition, it may be wise to perform a wedge shaped osteotomy through the dorsal surface of as many of the metatarsal bones as have caused callosities on the plantar surface of the foot. The removal of such wedges, with their bases situated on the dorsal surface of the metatarsal bones, if accompanied by a careful plantar fasciotomy, and especially if followed by careful after-treatment, cannot fail to lengthen the foot and to remove all sources of pressure if a transplantation of the extensor tendons has already been performed.

## OBSERVATIONS ON TENDON TRANSPLANTATION OPERATIONS

BY HERBERT P. H. GALLOWAY, M. D., WINNIPEG

Orthopedic Surgeon to the Winnipeg General Hospital, Lecturer in Orthopedic Surgery, Manitoba Medical College

THE exceedingly wide-spread prevalence of acute anterior poliomyelitis in Western Canada, in common with almost all parts of the North American continent, during the past three or four years, has afforded exceptional opportunities for studying every feature of this disease afresh. The amount of human wreckage cast upon the shores of orthopaedic surgery by this storm of paralyzing disease has been surprisingly large, and in consequence the writer has had an opportunity never before afforded him in such generous measure of studying and comparing the results of various surgical procedures for the relief of paralytic deformities in a sufficiently large number of cases to justify the formation of an independent judgment and the expression of a personal opinion in regard to their relative merits.

In the present paper it is the writer's purpose merely to record some of the conclusions arrived at from his personal experience with various applications of the operation of tendon transplantation in the treatment of paralytic deformities, particularly those due to poliomyelitis and spastic paralysis, and to describe and illustrate the technique followed in performing them.

There is something so peculiarly audacious and seductive about the proposal to deliberately transfer from one point to another the motor power of muscular contraction, even to the extent of completely reversing the normal action of the muscles, that once it had been demonstrated that this could be successfully accomplished, it is scarcely to be wondered at that in addition to the really useful operations devised, many fantastic and extravagant applications of the principle of tendon transplantation were proposed and tried, only to be abandoned later.

While in unusual cases exceptional procedures may with advantage be devised and carried out, there are not, in the writer's opinion, more than six or eight tendon transplantations in the lower extremity and two or three in the upper extremity that can be regularly employed with benefit.

One of the commonest deformities resulting from poliomyelitis is a more or less severe valgoid position of the foot. When, as frequently happens, this is due to paralysis of the tibialis anterior or the tibialis posterior, one or both, the other muscles governing the foot remaining

active, immense benefit may result from transplanting the peroneal tendons so as to give them an insertion to the os calcis just anterior to the inner border of the tendo achillis, and at the same time transferring the action of the extensor proprius pollicis from the great toe to the neck of the first metatarsal. When in addition to paralysis of the tibiales the gastrocnemius is also paralyzed, leading to calcaneus deformity, the operation of transferring the peronei to the os calcis is even more strongly indicated, as the peronei are capable of sufficient development to counteract to a considerable degree the dropping of the heel. In a few instances, instead of transplanting the peronei it is better to transplant the outer half of the tendo achillis to the inner side of the os calcis. The technique now employed was gradually improved in certain details as experience increased, and has now been used for several years with but little further modification. Before describing any of the operations in detail a few general principles may be stated:

- 1 Perfect asepsis is indispensable for success.
- 2 Attachment of the transplanted tendon to the bone or periosteum is always more satisfactory than attaching it to another tendon or other soft tissues.
- 3 The tendon must be stretched moderately tight before being secured.
- 4 It must be fastened with suture material that will maintain its hold for several weeks.
- 5 A covering of subcutaneous tissue should be brought over it before the skin is sutured.
6. Ample time (about six weeks) should elapse before the transplanted tendon is allowed to functionate, so that its new attachment may become sufficiently strong, further, the muscle should be systematically developed by massage and exercises and carefully protected by mechanical means from overstrain for several months after the patient begins to use it.

## TRANSPLANTATION OF EXTENSOR PROPRIUS POLLICIS TO NECK OF FIRST METATARSAL

*Group A.* Incision about an inch and a half in length extending backward from middle of great toe along inner dorsolateral aspect of foot. Tendon exposed and severed at anterior extremity of incision and dissected backward, including its sheath. Over the neck of the metatarsal the incision is deepened, going down through the soft tissues and periosteum. The periosteum is then scraped

Fig 1



Fig 2

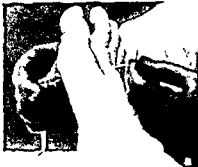


Fig 3

Fig 4

**GROUP A** Transplantation of extensor proprius pollicis to neck of first metatarsal bone. Fig 1—Extensor proprius pollicis tendon detached and suture secured to it. Fig 2 shows metatarsal being drilled and instruments for enlarging drill hole. Fig 3—Tendon being drawn into hole in metatarsal by forcing suture through bone and out through sole. Fig 4—Suture re-entered, passed around side of bone and made to emerge through original wound.

aside slightly so as to expose neck of metatarsal which is then completely perforated with a fine bone drill the hole being then enlarged and a funnel-shaped entrance to it provided with the instruments illustrated. Having estimated the length of tendon necessary to give the right degree of tension, No. 2 chromic catgut is secured to the tendon and the needle is passed straight through the hole in the metatarsal and made to perforate the sole of the foot re-entered about  $\frac{1}{8}$  inch from its point of exit and carried around the outer side of the neck of the metatarsal until it emerges in the original wound. If a straight needle has been used to perforate the sole it should be changed to a half-curved needle before re-entering it. To avoid any chance of infection from the skin a short incision in the sole between the points of emergence and re-entrance enables the catgut to be completely buried. Having been drawn tight so as to make the extremity of the tendon enter well into the metatarsal, the catgut is made to traverse the tendon and surrounding soft tissues once or twice before being tied. Then the transplanted tendon is covered by drawing over it the subcutaneous tissue with a continuous suture of plain catgut and the skin sutured with silk or gm gut.

While the description may seem to indicate a rather complicated procedure, the operation can easily be performed in fifteen minutes. The result of this operation is to transfer the action of the extensor proprius pollicis from the movable toe to the relatively fixed metatarsal, and the muscle becomes a fairly powerful dorsal flexor as well as tending to invert the foot.

I have a number of times, in addition to transplanting the extensor proprius pollicis, attached the tendons of the common extensor to the four outer metatarsals, using practically the same technique as that employed with the extensor proprius pollicis. This operation is particularly suited to those cases of pes cavus with slight equinus in which the toes are slightly dislocated upon the dorsal aspect of the heads of the metatarsals when the common extensor contracts. A preliminary operation to flatten the sole by subcutaneous division of the plantar fascia and wrenching are nearly always necessary in this class of cases two or three weeks before the transplantation is attempted, and the tendo achillis must usually be lengthened just before the transplantation of the extensor tendon is commenced.

#### TRANSPLANTATION OF PERONEI TO INNER SIDE OF OS CALCIS

**Group B** By a slightly curved incision about an inch and a quarter in length, extending downward and forward from a point slightly anterior to the peroneal tubercle, the peroneal tendons are exposed and cut off as far forward as the base of the fifth metatarsal. One or both tendons may be taken, as previously determined by the extent of the deformity, in most cases I choose both. A second short

Fig 1.



Fig 2.



Fig 3.



Fig 4



Fig 5



Fig 6

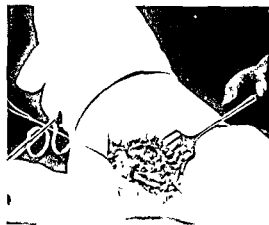


Fig 7

vertical incision is then made behind the fibula, a short distance above the malleolus and a blunt dissector or a strong closed artery forceps having been worked beneath the tendons they are then forcibly drawn through the opening. A third incision along the inner side of the tendo achillis, curving forward at right angles along the inner side of the os calcis near to and parallel with the sole, must also be made to permit exposure of the back part of the inner surface of the os calcis. With closed artery forceps a free tunnel anterior to the tendo achillis is quickly created, through which the free ends of the peroneal tendons are seized and drawn to the inner side of the heel. With a bone

knife or a fine chisel a strong bridge consisting of a thin layer of bone covered with periosteum and some of the subcutaneous tissue is raised from the inner side of the heel, beneath which the peroneal tendons are drawn and strongly sutured with chromic catgut, the wounds are then closed in the usual way, catgut being used for the subcutaneous tissues and silk worm gut for the skin, and the foot is held in the inverted position by plaster of paris bandages applied over the usual dressings.

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I frequently perform this transplantation and that of transplanting the extensor proprius pollicis to the neck of the metatarsal at one operation; and in the severest cases of paralytic valgus, an arthrodesis of the astragalo-scapoid articulation is done at the same time.

#### TRANSPLANTATION OF THE OUTER HALF OF THE TENDO ACHILLIS TO INNER ASPECT OF HEEL

Group C In certain cases instead of transplanting the peronei it is a most useful procedure to split the lower two

Fig. 1.



Fig. 2.



**GROUP C.** Transplantation of outer half of tendo achillis to inner aspect of heel. Fig. 1—Wound to expose tendo achillis and the region to which its outer half will be transferred. Fig. 2—Tendon split anteroposteriorly and outer half detached from os calcis. Fig. 3—Outer portion passed through tunnel created anterior to inner portion, and about to be grasped by forceps passed beneath periosteal bridge raised from os calcis. Fig. 4—Transplanted portion drawn beneath bridge and sutured.



Fig. 3

Fig. 4

or three inches of the tendo achillis by a vertical anteroposterior incision, detaching the outer half with a thin layer of the underlying bone, and then, after drawing the detached portion through a tunnel created anterior to the inner half of the tendon, attaching it to the inner side of the heel in a similar manner to that just described in connection with the transplantation of the peroneal tendons.

The cases demanding this operation are chiefly those in which the tendo achillis is slightly shortened so that the foot cannot be dorsally flexed to the normal extent. Under such circumstances, it is often plainly apparent that the tendon is an active evorter as well as a plantar flexor, as a preliminary step it is usually necessary to lengthen the tendon by a tenotomy performed by Beyer's method or through open incision, the transplantation being done about three weeks later.

In another class of cases the action of the tendo achillis tends to invert the foot, and in these it will often be found most useful to reverse the operation just described, transplanting the inner half of the tendon to the outer side of the heel.

#### TRANSPLANTATION OF TIBIALIS ANTERIOR TO OUTER SIDE OF TARSUS

**Group D.** In a few instances of paralytic varus the tibialis anterior may with advantage be transplanted to the outer side of the tarsus or to the base of the fifth metatarsal, secure attachment being obtained by drilling the bone and drawing the tendon through it. It is essential

to detach the tendon as far forward as its insertion extends, because it is rather difficult to secure sufficient length, and it must be dissected free to a point well above the ankle, for unless this be done the line of action of the transplanted tendon will not be sufficiently direct to allow it to act to the best mechanical advantage. Occasionally, to correct valgus, I have transplanted the common extensor as tendons after being severed near the toes being gathered together and drawn through a hole drilled through the scaphoid, but this will only be necessary under exceptional circumstances and is not here illustrated.

Another exceptional operation, very useful in certain cases of calcaneo valgus deformity is transplantation of the tibialis posterior so as to attach it to the os calcis just anterior to inner border of the tendo achillis.

These are practically all of the tendon transplantation operations in connection with the foot which have survived the test of my personal experience.

#### TRANSPLANTATION OF BICEPS OR SIMILAR MEMBRANOSUS TO PATELLA

**Group E.** Complete paralysis of the quadriceps is one of the most common results of a severe attack of infantile paralysis. This is a serious disability, rendering the patient very insecure through being totally deprived of the power to actively extend the leg upon the thigh. It may happen that the hamstrings are also paralyzed, in which case the patient must content himself

Fig. 1.

Fig. 2.

Fig. 3.



Fig. 4.

Fig. 5.

Fig. 6.



Fig. 7.

vertical incision is then made behind the fibula, a short distance above the malleolus, and a blunt dissector or a strong closed artery forceps having been worked beneath the tendons they are then forcibly drawn through the opening. A third incision along the inner side of the tendo achillis curving forward and at right angles along the inner side of the os calcis near to and parallel with the sole must also be made to permit exposure of the bony part of the inner surface of the os calcis. With closed artery forceps a free tunnel anterior to the tendo achillis is quickly created, through which the free ends of the peroneal tendons are seized and drawn to the inner side of the heel. With a bone

*(GROUP B.) Transplantation of peronei to inner side of os calcis.* Fig. 1—Peroneal tendons exposed and detached. Fig. 2—Instrument passed beneath tendons above and behind outer malleolus. Fig. 3—Tendons drawn through wound above and behind outer malleolus. Fig. 4—Loop suture passed through wound on inner side of heel and tunnel created anterior to tendo achillis. Fig. 5 shows jaws of forceps emerging above and behind outer malleolus and grasping free ends of tendons. Fig. 6—Tendons drawn through tunnel from outer to inner side of foot. Fig. 7—Tendons passed beneath periosteal bridge ready to be sutured.

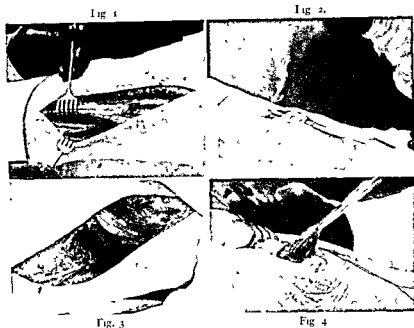
knife or a bone chisel a strong bridge consisting of a thin layer of bone covered with periosteum and some of the subcutaneous tissue is raised from the inner side of the heel, beneath which the peroneal tendons are drawn and strongly sutured with chromic catgut, the wounds are then closed in the usual way, catgut being used for the subcutaneous tissues and silk worm gut for the skin, and the foot is held in the inverted position by plaster of paris bandages applied over the usual dressings.

I frequently perform this transplantation and that of transplanting the extensor proprius pollicis to the neck of the metatarsal at one operation, and in the severest cases of paralytic valgus, an arthrodesis of the astragalo-scapoid articulation is done at the same time.

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*Group C.* In certain cases instead of transplanting the peronei it is a most useful procedure to split the lower two

**GROUP E. Transplantation of biceps to patella** Fig 1—Exposure of lower part of biceps and external popliteal nerve Fig 2—Patella exposed and strong periosteal bridge raised from its anterior surface. Also shows biceps detached and held up by suture Fig 3—Biceps winding around from posterior to anterior aspect of limb Fig 4—Extremity of biceps drawn beneath bridge raised from front of patella Fig 5—Extremity of biceps sutured to its new insertion on front of patella



there are only two which can be regularly performed with confident expectation of benefit, and the conditions requiring these are found in ordinary hemiplegia and in congenital spastic paralysis rather than in poliomyelitis

These two operations are (1) conversion of pronator radii teres into a supinator, and (2) conversion of the flexor carpi radialis and the flexor carpi ulnaris into extensors of the wrist

We are all only too familiar with the crippled position of the hand which so often results from hemiplegia, the wrist being acutely flexed, the hand fully pronated and the fingers almost or quite incapable of voluntary extension. If the deformity be severe the unfortunate patient is often very grateful for the improved appearance produced by the operation, which overcomes the extreme flexion and pronation, even though the fingers remain largely useless, while in the milder grades, where considerable voluntary power of extension of the fingers remains or can be developed, correction of the flexed and pronated position of the hand will often make the difference between a practically useless member and one that can be trained to perform many useful services

#### TRANSPLANTATION OF PRONATOR RADII TERES TO CONVERT IT INTO A SUPINATOR

**Group F** The technique followed in this operation is practically that described by Mr Robert Jones and Mr A. H. Tubby

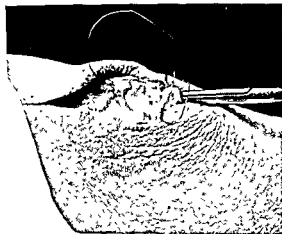


Fig 5

Incision about 4 inches in length following the course of the radial artery and extending from near the bend of the elbow to well below the middle of the forearm, the radial artery and nerve are isolated and carefully held aside, the pronator is easily recognized by the diagonal direction of its fibres, and its borders are well cleared. It will be found that its point of insertion to the radius varies considerably in different subjects, being sometimes high and sometimes quite low. Its broad flat tendon, together with the underlying periosteum, is carefully detached from the radius as low down as possible, for even then it will be found that it is scarcely as long as is desirable. A right of way through the interosseous membrane is then created by perforating the membrane with an aneurysm needle or a fine curved periosteal elevator, which is then vigorously worked up and down in close contact with the radius



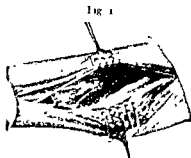


Fig. 1



Fig. 2.

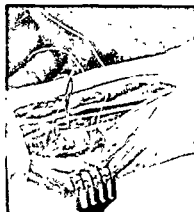


Fig. 3



Fig. 4

**GROUP I.** Conversion of pronator radii teres into a supinator. Fig. 1—Pronator radii teres exposed and nerve and vessels drawn aside. Fig. 2—Tendon of pronator detached from its insertion and about to be drawn through interosseous space by suture secured to it. Fig. 3—Showing extremity of pronator emerging at outer side of arm after being drawn through interosseous space and behind radius, also, one end of the double suture being passed through hole drilled anteroposteriorly through radius. Fig. 4—Extremity of pronator finally secured to radius.

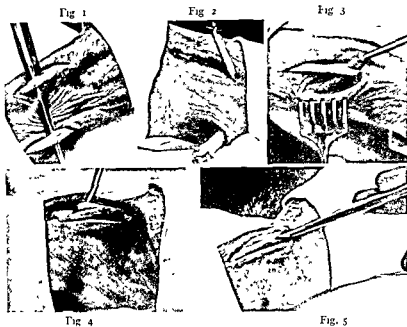
Great care must be exercised not to injure the interosseous nerves. Next a shallow depression  $\frac{1}{2}$  inch wide is created with bone nibbling forceps in the outer surface of the radius at the point where the new attachment of the tendon is to be made. By means of a strong double ligature of chromic catgut attached to its end the tendon is then drawn through the gap in the interosseous membrane and made to pass behind and to the outer side of the radius, one strand of the double ligature being then carried through a hole drilled through the radius anteroposteriorly, the needle transfixing the tendon as it lies behind the radius and emerging at the outer side of the bone before being finally tied to the other strand.

I have performed this operation quite a number of times and have found it exceedingly useful. After it has been done, the lessened resistance to supination is quite apparent. I confess, however, that I have never been able to fully satisfy myself to what extent the improvement is due to the muscle becoming an active supinator. I suspect that the improved condition of the arm results quite as much from the muscle being completely shorn of its power to act as a pronator.

This doubt arises from the fact that the method of anchoring the end of the tendon is much less satisfactory than where the tendon is passed under a strong bridge of periosteum. This latter method is impracticable in connection with this particular operation, because the tendon cannot be satisfactorily detached from its insertion and at the same time left sufficiently long, without removing with it a considerable portion of periosteum from the outer side of the radius just at the point where the bridge is required.

#### CONVERSION OF FLEXOR CARPI RADIALIS AND FLEXOR CARPI ULNARIS INTO EXTENSORS OF THE WRIST

**Group C.** This operation is nearly always performed at the same time as the transplantation of the pronator radii teres or as a secondary operation two or three weeks afterwards. Briefly the insertions of the flexors are exposed through short incisions directly over them on the front of the forearm. Using all care so as not to wound the surrounding vessels and nerves, the tendons are de-



GROUP G Conversion of flexor carpi radialis and flexor carpi ulnaris into extensors of the wrist Fig 1—Tendons of flexor carpi radialis and ulnaris exposed in front of wrist Fig 2—Showing tendons detached from insertion Fig 3—Flexor carpi ulnaris drawn to back of wrist and made to perforate extensor carpi ulnaris Fig 4—Flexor carpi radialis drawn to back of wrist and made to perforate tendon of extensor carpi radialis longior Fig 5—Final suturing of flexor carpi radialis to extensor carpi radialis longior

tached close to their insertions with a stout bone knife kept close to the bone, the detached tendons are then cleared for a couple of inches above the wrist. After exposing the lower part of the extensor carpi ulnaris through an incision behind the lower part of the ulna, a tunnel is created beneath the skin, the end of the flexor tendon drawn through and securely stitched as low as possible to the tendon of the extensor. Similarly the flexor carpi radialis is carried to the back of the wrist and attached to the tendon of the extensor carpi radialis longior. Attaching tendon to tendon is never as satisfactory as attaching tendon to bone, but in this operation no other method is available. In order to make the anchorage as secure as possible, the extensor should be perforated and the flexor drawn through it before being stitched as shown in the diagrams. By repeating the same technique on the radial side of the arm, the radial flexor can be securely attached to the extensor carpi radialis longior. Even if it were granted that no positive action of the transplanted flexors could reasonably be expected, the advantage of depriving them completely of their power to flex the wrist will hardly be disputed by anyone who has examined one of these patients before and after the operation, but I am convinced that the transplanted muscles do exert a positive extending action, provided the operation has been properly done so as to securely anchor the transplanted tendons to their new insertion. Attempts have been made to attach a portion of the trapezius to the paralyzed deltoid with the hope of restoring some degree of power to the latter. I have had limited experience with this operation, but regard it as useless.

Much has been said and written about Lange's method of elongating tendons and making

artificial ligaments by means of silk. In connection with all ordinary tendon transplantation elongation with silk is quite unnecessary if care be taken to secure all the length possible by detaching the tendon directly from its insertion. The unnecessary introduction of a foreign body like silk is to be deprecated, but in replacing a partly destroyed tendon, as for example a destroyed ligamentum patellæ, Lange's method of using silk so as to form a kind of framework about which nature can construct a new tendon will be found of immense service. It has also a limited application in the creation of artificial ligaments about flail joints.

In the foot, arthrodesis may sometimes be combined with tendon transplantation with the greatest advantage, thus, in very severe valgus, if the astragaloscaphoid joint be very lax, arthrodesis of this joint may sometimes be combined with transplantation of the peronei and extensor proprius pollicis, while in severe varus a wedge from the outer side of the tarsus may be required in conjunction with transplantation of the inner half of the tendo achillis to the outer side of the heel, or of the tibialis anticus to the outer side of the tarsus. The scope of this paper does not, however, permit any extended discus-

sion of the exact indications for these combined operations nor of the technique used in performing them

The thirty-four original illustrations accompanying this article are reproduced from photographs of the various operations performed on the cadaver. My warmest thanks are due to Professor Watt of the Anatomical Department of

Manitoba Medical College for placing the necessary anatomical material at my disposal and for his kindly and interested co-operation in various ways; also to his assistant, Mr. C. B. Lewis, whose skill in photography was most helpful. I am also greatly indebted to Dr. S. Alwyn Smith for valuable assistance in getting the various dissections ready to be photographed.

## THE TECHNIQUE OF TUBAL STERILIZATION

By IRLE J. TAUSSIG, M. D., Sr. LOUIS

Gynecologist to the St. Louis City Sanitarium

THE rather frequent occurrence of pregnancy among insane women who, either because of improvement in their mental condition or at the request of relatives, have been discharged from the sanitarium, brings up the question of sterilizing such women before permitting their departure. Such measures seem doubly advisable, on the one hand because of the frequent detrimental influence of pregnancy upon the psychosis, and on the other hand because of the almost invariable hereditary transmission of the psychosis to the progeny. When we consider the predominant rôle played by heredity in the causation of insanity, steps taken toward diminishing the number of children born of insane mothers certainly seem justifiable. While the human race is barely awakening to its responsibility in the problems of eugenics, and the laws of this country do not as yet generally recognize the right to perform sterilization operations *per se*, nevertheless, if done in association with other operative work, there can be no objection.

In my service at the City Sanitarium, while operating for movable retroversion, ovarian cyst, one-sided inflammatory trouble, and other gynecologic ailments, I have had occasion a number of times, always with the consent of the patient's relatives and upon consultation with the superintendent, Dr. George A. Johns, to include the operation of tubal sterilization. From the unfavorable reports of other surgeons and from personal experience, a somewhat modified technique has been evolved and employed in the last four cases. In operations of this kind it is difficult to estimate the comparative value of different methods except by a priori reasoning and occasional failures.

Simple ligation of the tubes with excision of a small piece has not been uniformly successful,

probably owing to the patency of the uterine end of the tube after the ligation of the tube had cut through. Similarly the excision of the interstitial portion of the tube at the uterine horn resulted in one of Kuestner's cases in pregnancy following the operation through the formation of a utero-abdominal opening. Asch and Labhardt employ a technique by which the cut end of the uterine portion of the tube is slipped within the folds of the broad ligament. The objections to this technique as I see it are the possibility of a small rent in the peritoneum of the broad ligament, allowing of possible impregnation, and the danger of the development of a hydro-salpinx in the sealed portion of the tube. It is this same likelihood of a hydro-salpinx that is in my mind so strong an objection to those methods of sterilization in which the fimbriated ends of the

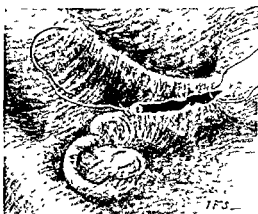


Fig. 1. The interstitial and isthmic portions of the tube have been removed. The ligation in the uterine horn has not yet been tied.

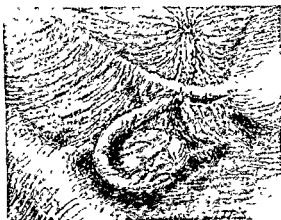


Fig 2 The ligated end of the remaining portion of the tube has been drawn down between the folds of the broad ligament and fastened there by a suture through the anterior sheath of the ligament

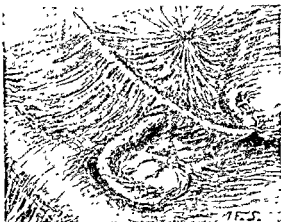


Fig 3 The round ligament is sutured over the cut in the uterine horn, covering this and the opening in the broad ligament at the same time

tubes are either sewed into a fold of the broad ligament or drawn upward through the inguinal canal and there tied off. It therefore seemed wise to somewhat modify the technique heretofore employed.

The technique of my operation is as follows. The abdomen is opened by a small median incision in the usual manner and the uterine end of one Fallopian tube seized with forceps. The uterus is thus pulled into view so that a suture can be passed through the uterine horn at the tubal insertion. Before tying this suture, the interstitial portion of the tube is cut away by a V-shaped incision. Next, the tube is freed from its peritoneal attachment for a distance of about one inch and, a ligature having been thrown around the distal end, this free portion of the tube is resected. Figure 1 shows conditions at this point in the operation. It will be seen that the needle is left threaded in the ligature thrown around the tube.

With an artery forceps or Mayo dissecting scissors the layers of the broad ligament are separated from each other at the point where it has been opened up. Catching the end of the tube with an extra suture to prevent it from slipping, the threaded needle is now passed through the open space in the broad ligament, and emerges just anterior to the round ligament near the attachment of the vesical peritoneum to the uterus. An extra suture is passed through the peritoneum at this point so as to completely bury this end of the Fallopian tube in the broad ligament (Fig. 2).

The third step in the operation (Fig. 3) con-

sists of sewing the round ligament by one or more sutures to the upper posterior surface of the uterus, thus closing over the point of the tubal insertion and the small open space in the peritoneum of the broad ligament.

The same technique is observed in resecting the tube of the other side, and the abdomen closed in the usual manner.

In cases of movable retroversion the round ligaments can be folded back far enough to meet in the median line on the posterior surface of the uterus and hold that organ forward and upward.

The advantages of this technique are its greater security against possible conception. The steps are so simple and easy as to require but a few minutes, and the additional precautions would seem to be worth while.

To specify the advantages of the technique employed, we have:

- (1) Resection of the narrowest part of the tube (the interstitial portion)
- (2) Closure of the uterine wound by a double layer, first of the uterine wall, second of the round ligament
- (3) Burying of the proximal end of the cut tube far away from the uterine horn
- (4) Prevention of hydro-salpinx by leaving the fimbriated end of the remaining portion of the tube open

The operation just described can be done vaginally as well as abdominally, but, except for patients with prolapse or relaxed pelvic floor, the abdominal route is preferred on account of its simpler technique.

## IMMEDIATE CLOSURE IN PERINEAL PROSTATECTOMY

BY ARTHUR E. HERTZLER, M. D., KANSAS CITY, MISSOURI

IT has always seemed to me that to pack a fresh wound in order to control hæmorrhage and secure drainage, as is done in the accepted operations for the removal of the prostate, is out of keeping with modern surgery. In order to meet this very obvious objection I published an article some time ago,<sup>1</sup> describing an operation from which this defect is eliminated. The operation as proposed is ideal, but is limited by several factors. It is not suitable when there are stones in the bladder or when there is a pedunculated lobe extending into the bladder. The chief objection, however, is that it appears more difficult than it really is.

To meet the indications of modern surgery and at the same time remove these limitations in my first operation, I have modified it so that it is applicable to all cases except radical excision for malignancy, and stone or pedunculated lobe or timidity need not be a bar to its performance.

The method varies from Young's classic operation in two particulars. (a) the hæmorrhage is controlled by ligature and the cavity occupied by the prostate is obliterated by suture, (b) the opening made into the urethra is sutured hermetically about a drainage tube. This keeps the urine from the wound and permits it to be conducted to a receptacle beside the bed, as in drainage of the gall-bladder.

In detail the following points may be emphasized. The patient must be properly placed on the table. Young's suggestion of elevating the hips of the patient is not fully appreciated by many operators. This simple modification in position makes it possible to view all parts of the field of operation.

The incision and instruments suggested by Young are ideal. A free incision of the soft parts is necessary in order to obtain the greatest possible exposure of the region. The urethra from its exit from the prostate to its disappearance behind the bulb should be visible. The lower and posterior surfaces of the prostate should be freed, and all hæmorrhage should be controlled by grasping the bleeding points with forceps and ligatures applied just as would be done in any operation.

With the field of operation thus exposed in Young's manner, I suggest the following procedure:

The urethra is opened back of the bulb by an

incision 2 cm long. The bladder is explored, and if stones are present they are dealt with. The form and size of accessory lobes are noted. A Young's tractor is now passed, and the prostate brought as deeply into the wound as is consistent with perfect safety to the soft parts. The capsule of the prostate is then incised and the separation of the lobes is begun. The finger, scissors and knife each has its place, and since the wide incision permits a knowledge of the size and form of the prostate as well as of the nature of the tissues, the lobe can be excised with precision. Whenever, during this procedure, a vessel of any magnitude is severed, it is clamped and ligated. No more time is required to ligate at this time than later, and the clamp is out of the way and is available for use again. When one side is removed the space is explored for any actively bleeding points, which are caught up and ligated. There will still be considerable oozing from the surfaces. The cavity is now temporarily packed with a strip of plain gauze.

The other side is now excised in the same way. The pedunculated lobe is now removed by pushing it into the site of one of the lateral lobes. This is most conveniently done by removing the packing from the side first operated upon and pushing the lobe into this cavity. If the pedicle is narrow and the lobe small it may be removed through the urethra.

When the enucleation is completed the packs are removed from the cavities previously occupied by the lateral lobes and the obliteration of the cavities commenced. This is done with a No. 2 catgut mounted on a medium size full-curved round needle. The sides of the cavities are brought together (Fig. 1), thus obliterating the space and checking any tendency to oozing that may still be present. The amount of tissue available for this closure will depend on the skill with which the previous steps of the operation have been performed. Theoretically, the capsule of the gland should be available, but in practice it is often bladder, rectal wall, or levator fascia, or even tissue for which the operator is not ready with a name that would be recognized by the B. N. A. Be this as it may, there is a cavity with walls and this cavity can be obliterated by bringing these walls together by successive sutures, either continuous or interrupted.

Either after or before the obliteration of the cavities the drainage tube is passed through the

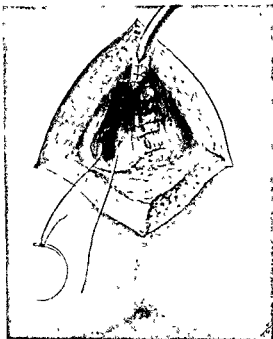


Fig 1

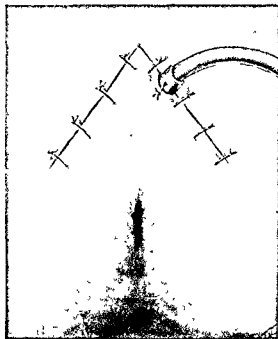


Fig 2

incision into the urethra to just within the bladder. The incision into the urethra is now closed snugly about the tube so that the urine cannot escape (Fig 1). The tube should be fastened to the skin by means of a suture in order to prevent it from slipping too far within or without the bladder. The collar about the tube, as shown in Fig 2, is secured by drawing a slightly larger tube over the one used for drainage. This permits anchoring the tube without perforating its lumen. I am indebted to my colleague Dr Harrelson for this suggestion.

After the tube has been securely sutured into the urethral opening the incision into the superficial soft parts is closed by deep silk worm gut sutures (Fig 2). No drain other than the tubular drain into the bladder is used. A dry pad is used over the wound, perforated to permit the passage of the drainage tube.

After the patient is returned to his bed, a longer tube is attached by means of a short glass tube, and the urine conducted to a receptacle at the side of the bed.

If any clots form in the bladder from hæmorrhage due to intravesical manipulation, such as stone extraction or removal of a pedunculated polyp, they can be removed by disconnecting the drainage tube at its junction with the glass tube

and the clot aspirated by means of a Janet or similar syringe. Irrigation may be done through this tube if it seems desirable.

The length of time the drainage tube should remain in place is a matter of conjecture. It should remain theoretically long enough for the wound to have healed sufficiently so that the contact of the urine after the removal of the tube will not affect the line of incision. Tissue is not available for studying the rate of healing in the human subject. It can only be stated that in lower animals the change from fibrin to fibrous tissue begins at three or four days and is well advanced in six or seven. For the want of more definite information I have allowed the tube to remain in from four or five to even six days. The neck of the bladder ordinarily tolerates the tube if it has been well placed, and by this time the wound will no longer break down when the urine flows over the perineum.

If the removal of the prostate and the closure of the cavity have been done with precision, instead of bringing the drainage tube out of the perineal wound a large catheter may be passed down the urethra into the bladder, and the wound closed about it. As large a catheter as the penile urethra will admit should be used. The opening into the urethra and the soft parts are then closed

without drainage. The operator should not become timid at this point and pass a gauze drain down to the incision into the urethra, for this will most certainly cause failure of union. The catheter is allowed to remain in position from seven to ten days. I have used immediate closure in external urethrotomy with success for a number of years, and it seems to work as well where the removal of the prostate is added. I have not attempted the catheter method unless the urine was relatively free from infection.

The advantage of this method of operating has been the definite abandonment of all gauze packs and drains in the perineal wound. Less blood is lost because the large vessels are caught up and definitely ligated at once. The bed has been kept clean and the patient dry for four or five days during his severest illness, when the drain is through the perineum, or permanently when the

catheter is used. There is far less abscess formation about the stitches and in the superficial parts, and fat necrosis is less likely. The final closure of the perineal incision is hastened and complete closure is much more certain. The objection that may be raised against the operation is the longer time required for the operation. Forty-five minutes will be required for the average operator. An especially skillful operator should reduce this time. The possibility of infection may be raised. If infection occurs the superficial sutures may be removed. I have never had more than a portion of the external wound break down, nor has there been serious infection threatening the life of the patient. The operator should be able to judge his patient. The healing power of the patient and the state of the urine furnish an index, though I have used this method with success in old men with urine by no means sterile.

## A TUBERCULOUS CYST, PROBABLY OF PANCREATIC ORIGIN

By J. M. MASON, M. D., BIRMINGHAM, ALABAMA

Gynecologist to St. Vincent and Hillman Hospitals

AND

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Physician to Out-patient Department St. Vincent Hospital, and Pathologist to Hillman Hospital

WHILE the pancreas is singularly immune from tuberculosis, milary tubercles are sometimes found in association with tuberculosis of other parts of the body. Kuderewsky found milary tubercles of the gland in twelve of one hundred and twenty-eight cadavers with tubercles of other organs, 44.44 per cent being in children. The pancreas was secondarily involved in six out of eighteen cases of acute milary tuberculosis (1).

Hale White's series of one hundred and forty-two autopsies showed less than one per cent of involvement of the organ in all cases of tuberculosis (2).

The disease frequently begins in lymphatic glands in contact with the pancreas or even within the substance of the gland (3).

Primary tuberculosis of the pancreas is exceedingly rare. Opie (1) cites the cases of Aran, Chvostek, and Mayo as examples of primary tuberculosis, while Robson and Cammidge only mention the case of Mayo (2).

Adami, Opie, and Robson all refer to the case

of Sendler, whose patient, a woman, presented a small tumor above the umbilicus, and suffered with pain and vomiting. At operation the tumor was found in the head of the pancreas, and upon removal it proved to be a tuberculous lymphatic gland. It is possible that some of the other cases mentioned may have been of this nature.

A careful search through the literature does not show any record of tuberculous cyst of the pancreas, hence the following case will perhaps be of more interest from a pathological than a surgical standpoint.

*History.* P. C., colored female aged 27, entered the Gynecological service at St. Vincent Hospital, on June 9, 1911. She was referred by Dr. J. B. Cooper. A tumor distended the abdomen to the size of a full term pregnancy. She gave the following history:

Mother alive and well, father died from accident, only one other child in the family, a brother, who is alive and well. There is no family history of tuberculosis and she has not been exposed directly to the disease as far as she knows. She was married at the age of 15, and has had five children and two miscarriages.

Eight or ten years ago she noticed a tumor the size of

an egg in the middle line some distance above the umbilicus. It occasioned no inconvenience, but she noticed that it slowly increased in size, and finally began to cause an occasional sensation of nausea and giddiness. She had no colics or jaundice and continued in good general health, giving birth to several healthy children. During the past three or four years the growth has been more rapid, particularly in recent months, and her last two pregnancies have resulted in miscarriages or abortions.

**Examination.** Examination revealed a large fluctuating tumor bulging prominently in the epigastrium and extending downward in the abdominal cavity, particularly on the left side, reaching as low as Poupart's ligament and extending well into the left loin. This region was dull on percussion, while the right side showed a good deal of tympany. The uterus was normal in size and position, there was no apparent connection between the tumor and either tube or ovary, and the cyst did not extend into the pelvis.

The lungs and heart were normal, as was also the urine. The temperature was 100½, the pulse 102 and the leucocyte count 8,500. Further physical examination was negative.

A probable diagnosis of pancreatic cyst was made, though before exploration other conditions could not be entirely excluded.

**Operation.** An incision was made through the left rectus. The cyst was firmly adherent to the anterior abdominal wall above the umbilicus, but was free below and on its under aspect. It was aspirated and three and one half litres of purulent material were drawn off. Probably half a litre more was sponged out and escaped. The walls were covered with thick cheesy material which could not be entirely removed. The uterus tubes and ovaries were found to be entirely normal and unconnected with the cyst. The stomach and colon were displaced into the pelvic cavity, the colon being behind the symphysis and the stomach, occupying even a lower position in the pelvis. The tumor had evidently gone forward between the liver and stomach, pushing the gastrohepatic omentum in front of it and gradually crowding the stomach farther and farther downward. The gastrohepatic omentum was very much thickened and could be seen going from the stomach to the surface of the cyst.

The left half of the abdominal cavity was filled by the cyst, but the right side was not so much encroached upon, the small intestines being crowded over into this side.

The hand could be passed behind the sac well up toward the diaphragm, where its attachment ran in a transverse direction across the upper abdomen. Both kidneys were in position and had no apparent connection with the cyst. In front and on the anterior aspect of the sides the cyst could not be traced owing to the dense adhesions. The peritoneum, except for the anterior adhesions, was perfectly normal.

Enucleation was considered, but we found it impossible to remove the sac from the anterior abdominal wall, every effort resulting in tearing into the sac. A large part of the cyst wall was, therefore, drawn up from below and excised, after which the remainder was attached to the abdominal incision and the cyst cavity packed. A drain was passed into the peritoneal cavity.

The patient made an uninterrupted recovery, and at the time of our last examination, two weeks ago, the cavity had filled with the exception of a small sinus less than two inches deep and hardly half an inch in diameter.

Unfortunately the fluid from the cyst was thrown out before the operation was finished, and no observations on its chemical constituents could be made. However, Nothnagle discounts the value of these examinations from

a diagnostic standpoint (4). A small quantity on culture medium remained free from growth.

Microscopic examination of the excised cyst wall made by Dr. E. M. Mason showed the following conditions:

"Section of cyst wall. Diagnosis Tuberculosis."

"Thickened fibrous tissue with few scattered tubercles containing giant cells; isolated accumulations of round cells—probably early stage of abscess formation."

"Sections were stained for tubercle bacilli but with negative result."

This examination confirmed the diagnosis made from the clinical appearance of the cyst wall and contents.

These findings were of such interest to us that we sent the material, together with the case report, to Professor E. L. Opie, who kindly made the following report on his examination:

"Section marked 185 Cyst-wall Pancreas. The section on one side, consists of dense fibrous tissue, much of which has undergone hyaline degeneration. This tissue is the site of acute inflammation and contains numerous polynuclear leucocytes. On the other side of the section, the tissue is much more cellular and there is no hyaline degeneration, here lymphoid and plasma cells are numerous, together with a moderate number of polynuclear leucocytes. As the surface is approached, similar cells occur closely packed together, here and there are giant cells with nuclei arranged about the periphery, in the immediate neighborhood, cells of epithelioid type are numerous. No typically formed tubercles occur."

"Second section resembles closely the first. The tissue, in great part, is dense, fibrous and in places hyaline; cellular areas occur and here an occasional giant cell of the type previously described is found. In places eosin stains very sharply defined collections of 'fuchsin bodies.'"

**Remarks.** "The appearance is that of a chronic tuberculous process and I feel little doubt that the lesion is tuberculous. In the sections examined, there are no typically formed tubercles and no foci of caseation. There is, moreover, evidence of acute inflammation. The sections examined contain no pancreatic tissue."

In establishing our diagnosis, we must consider cysts of the liver, the gall-bladder, the spleen, the mesentery, the kidneys and the adrenals.

The kidneys and mesentery may be at once disposed of, as these were either under plain sight or touch and had no connection with the cyst.

The gall-bladder may be eliminated, as a cyst of this viscus would have developed along the right rather than the left side of the abdomen, in a manner exactly opposite to that found in the present case.

It is inconceivable that a splenic tumor would have first appeared as a small round tumor in the middle line, for the organ would have enlarged greatly downward and forward before it would reach the middle line at all.

The classical paper of McCosh on Suprarenal Cysts (5) gives the principal differential points between suprarenal and other deeply seated retroperitoneal cysts. He gives the following differential points: Onset is usually slow, with pain in the hypochondrium of the affected side. Sometimes the onset is sudden, owing to the



occurrence of hæmorrhage into the cyst; bulging under the free border of the ribs; urine may or may not be abnormal; kidney is usually displaced downward; the pancreas forward and downward; the liver upward, forward and toward the middle line; the colon in front, and the kidney generally adherent. The cyst is more fixed to the tissues of the back than is the case with cyst of the pancreas. In his own case, and in six cases cited by him, the tumor was located in the hypochondrium or loin.

A suprarenal cyst whose sac showed "chronic diffuse inflammation probably tuberculous in origin" is reported by Jonas. While this cyst did not in any way resemble mine in its location and attachments, its contents and the wall of the cyst did resemble it closely. However, in his case the course of the disease was very acute, almost exhausting the patient within a month, at the end of which time it was successfully removed (6).

Liver cysts may be divided into parasitic cysts, retention or bile cysts, simple cysts, congenital in origin and usually due to malformations and multiple cystic disease. In the present case, all these may be dismissed except the simple congenital cysts. Nothnagle reviews this subject at some length (4). Usually the cysts are discovered at birth and frequently obstruct delivery, as in cases reported by Witzel, Sanger, and Kloppey. Many small cysts the size of walnuts have been found about the region of the suspensory ligament of the liver without giving rise to any symptoms. A few large cysts, evidently of this congenital origin, and situated about the suspensory ligament have been subjected to operation and reported, and it would appear that

these belong to the class of small quiescent congenital cysts which have taken on rapid growth owing to the action of some inflammatory or irritative influence (4). Henderson from Mayo's clinic has recently reported a successful removal of a cyst from the round ligament of the liver of the size of a child's head. The tumor occupied a position in the right hypochondrium (7).

It is at once apparent how little the case here presented resembles any of these; our final diagnosis being based on the slow onset with tumor in the middle line high up; from its developing along the left rather than the right side of the abdomen; from its relations to the stomach, colon, and gastrohepatic ligament, from its evident lack of connection with kidneys or mesentery; from its lack of resemblance, attachments, or development along lines followed by cysts of spleen, gall-bladder, suprarenals or liver.

Whether the tubercles were secondarily deposited in the cyst, or whether the cyst was a result of tuberculous infection of the gland, we are not prepared to say.

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## A SELF-INVERTING SUTURE FOR THE APPENDIX STUMP

By WILLARD BARTLETT, A. M., M. D., St. Louis

ONE may preface the description by stating that the writer hesitates to add one more to the existing large number of proposals for treating the appendix stump, most of which are no doubt thoroughly useful.

This stitch is quickly put in and is self-tucking. Thus one avoids the difficulty which is very often encountered, of inverting the bowel after a purse-string has been introduced. It dispenses with the en masse ligature by scrupulous care in ligating separately any blood-vessel which is divided on the intestinal wall, as well as those in the

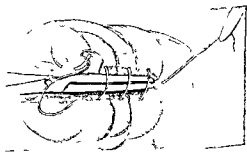


Fig. 1.

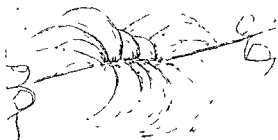


Fig 2

mesenteroleum. Fig 1 illustrates the introduction of the suture. Fig 2 shows forceps withdrawn, and the suture partially drawn taut at the same time inverting the bowel. Fig 3 makes

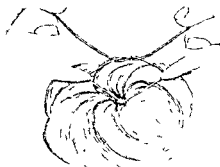


Fig 3

clear the completion of the operation; the ends of the thread being tied together, thus invaginating one line of sutures and forming another layer, making it all the more reliable.

## AN UMBILICAL CORD CLAMP (PRELIMINARY NOTE)

By FRED L. ADAIR, M. D., MINNEAPOLIS

Assistant Professor of Obstetrics and Gynecology, University of Minnesota

**C**LAMPING the umbilical cord has some advantages over the ordinary methods of ligation. I shall not enumerate them at this time. Most of the clamps used for this purpose are heavy and unwieldy. I have devised and used a simple clip, in a small series of cases, with considerable satisfaction. These clips are cut from a sheet of aluminum, such as dentists use for plate work. They are 5 cm. long, 0.7 cm. wide, and gauge No. 19. This strip is ground smooth and bent near the middle. On one end a little projection is made, long enough to be bent over the free end after the clamp has been applied to the cord.

After the cord has ceased pulsating, it is compressed with a pair of artery forceps close to the skin margin.

The clip is then slipped into the compression, one arm on either side of the cord. It is then squeezed tightly together with the artery or needle forceps, and the little projection bent over the open end. The cord is then cut close to the clip.

The accompanying drawings show the clip before it is bent (Fig. 1), ready for application



FIG. I.



FIG II



FIG III.

(Fig. 2), and its position after compression (Fig. 3).

This may be removed subsequently, or left in place until it falls off with the cord. This usually takes place about the third or fourth day.

# EDITORIALS

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JANUARY, 1913

## INTERNATIONAL ABSTRACT OF SURGERY

The new International Abstract of Surgery, which will be issued by SURGERY, GYNECOLOGY AND OBSTETRICS as a supplement to that journal will appear with the February issue

The scope of this new venture was described in an editorial in the November number of SURGERY, GYNECOLOGY AND OBSTETRICS. Because of uncompleted contracts with the publishers of the foreign periodicals with whom we are to co operate in this important innovation, we considered it premature to announce the names of these journals. Besides, as SURGERY, GYNECOLOGY AND OBSTETRICS is the official journal of the Clinical Congress of Surgeons of North America, the editor was anxious to receive the stamp of approval of that body on his negotiations with the foreign publications

and his plans for the organization of this departure.

The following resolution introduced by Dr. J. Bentley Squier at the business meeting of the Clinical Congress of Surgeons of North America, held at the Waldorf-Astoria, New York City, November 12, 1912, duly seconded and approved by a unanimous vote of the Congress, conveys the authority sought and also gives the exact names of the periodicals and the publishers with whom contracts have been made.

"WHEREAS, Dr Franklin H. Martin, Managing Editor of the official journal of the Clinical Congress of Surgeons of North America, has entered into an agreement with the editors and Julius Springer, of Berlin, publisher, of the new Zentralblatt for Surgery and the new Zentralblatt for Gynecology, viz :

*'Zentralblatt für die gesamte Chirurgie und ihre Grenzgebiete'*

*'Zentralblatt für die gesamte Gynakologie, Geburtshilfe und ihre Grenzgebiete'*

which have been authorized by the German Surgical and the German Gynecological Congresses, respectively, and also with the editors, Masson & Co, of the *Journal de Chirurgie* of Paris, France, for the purpose of establishing an INTERNATIONAL ABSTRACT OF SURGERY, which will be a supplementary journal to SURGERY, GYNECOLOGY AND OBSTETRICS,

"Be it resolved, that we, the accredited members of the Clinical Congress of Surgeons of North America, at its annual meeting for the transaction of business, do hereby commend and confirm the agreements and understand-

ings entered into with these foreign organizations, and further wish to emphasize our loyalty to and support of this new progressive enterprise of the editor of our official journal "

#### THE NEW BUSINESS ARRANGEMENT WITH SUBSCRIBERS

SURGERY, GYNECOLOGY AND OBSTETRICS with the supplement, the new INTERNATIONAL ABSTRACT OF SURGERY — the two combined doubling the size and cost of publishing SURGERY, GYNECOLOGY AND OBSTETRICS as it now appears — will be sent to all paid subscribers of the journal until May, 1913, without additional cost. This will give our subscribers an opportunity to judge of the importance, to them, of this change and to realize, judging from a business standpoint, that the journal publishers will be obliged to ask a proportionate increase in the subscription price

Theoretically, the price of the two publications should be double the present one. This is based on more than double the presswork, paper and mailing price and still greater proportion of compensation for the preparation of the contents represented in the index and abstracts, besides the subscription cost of a complete list of journals of the world from which the index and abstracts are made.

While these things are true, it is obvious to any business mind that there are a considerable number of general expenses connected with the publication and exploiting of a single journal that would not be doubled by increasing its size, if it was still issued as one publication. If there is considerable demand for the breaking up of the journal into two or three separate journals, as for illustration, (a) SURGERY, GYNECOLOGY AND OBSTETRICS in its present form; (b) SURGERY, GYNECOL-

OGY AND OBSTETRICS combined with the surgical abstract journal; (c) the surgical abstract journal alone — the combined costs would be more than doubled. It is, therefore, the desire of the editors to publish one comprehensive surgical journal, combining the requirements of all surgeons, for one price.

Because of this desire, there will be a three months' try-out of the two publications under one cover, during which time there will be no increase in price to our cash subscribers. In the meantime, an extensive campaign will be conducted among our present subscribers with the idea of determining their wishes in the matter. If, as we hope, a large proportion of the present subscribers welcome and support the one journal and a substantial interest is shown in the new enterprise by surgeons who have never been subscribers to the present journal, it will be continued as one publication.

A great expense is involved in this new enterprise. For one year extensive negotiations have been conducted with foreign editors and publishers and important contracts have been negotiated. Considerable capital is required to begin this new publication, to pay for material, to pay for journals, to pay for proper publicity. It is not only a problem for the publishers, but it is the most important literary problem that has been presented to the surgeons of America and Europe in this generation.

When our readers have had an opportunity of judging of the worth of our efforts, we hope they will show their appreciation by assisting us to decide how we shall furnish them the material, and be as loyal in their financial support of the journal in the future as they have been in the past.

FRANKLIN H. MARTIN.

## THE CANCER CAMPAIGN

One evening of the Clinical Congress of Surgeons of North America was given over to the consideration of cancer of the uterus. It has long been realized that most of these cases reach the surgeon too late for operation, and it was apparent to all that the medical profession must wage a campaign of publicity if the women of the country were to be made aware of the fact that in the early stages of the disease a large number of the cases could be cured by operation.

Former educational campaigns, aiming to enlighten the general practitioners as to the necessity of referring all cases of cancer to the surgeon early, have proved of little value, simply because the physician as a rule sees the patient but a few days before he or she is referred to the surgeon. It was therefore clear that it was the people, and not the physicians, that should be educated.

If the legal fraternity wishes to enact a new law or if a given society wishes to carry on a campaign they at once go directly to the people, using the daily press as a medium. The daily paper is, as was recently aptly described in an editorial, the primer of the people.

The Clinical Congress appointed a Committee of five consisting of Dr H C Taylor, 32 West 50th St, New York; Dr E C. Dudley, 32 N State St, Chicago; Dr C Jeff Miller, 124 Baronne St, New Orleans; Dr F. F. Simpson, Jenkins Arcade Bldg, Pittsburgh; and Dr Thomas S. Cullen, as Chairman, 3 W. Preston St., Baltimore, to wage

this campaign, and explicitly instructed them to write or have written popular articles on the subject of cancer and to have these published in the daily press, the weekly or monthly magazines, or journals as was deemed most expedient. The resolution creating this board was unanimous.

This cancer campaign question was reopened at a session of the Congress a day or two later and the scope of the Committee was enlarged to include all forms of cancer that may attack the race.

Already some of the best known magazines have asked for articles on cancer. In the course of a year it is hoped that the people of the United States will be able to find, in the current literature that they are accustomed to read, simply written articles on every variety of cancer about which they should have a clear knowledge. When the laity realize that cancer in its early stages is a local and not a blood disease, and that if taken in time at least 25 per cent of them may be permanently cured, then they will present themselves early for treatment, instead of as now seeking to hide their malady until, as a result of pain or their weakened condition, they are forced into the open and are compelled to seek medical and surgical advice, which then can offer little or nothing.

Every reader of this journal fully appreciates the great need of this campaign of enlightenment and education, and the Committee may rest assured of the heartiest co-operation of the physicians and surgeons of the United States and Canada.

THOMAS S. CULLEN

# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD JANUARY 19, 1912, WITH THE PRESIDENT, DR. C. A. PADDOCK,  
IN THE CHAIR

### SARCOMA OF OVARY

DR. M. T. GOLDSTINE: The tumor in this case was not larger than a navy bean, and no other tumors could be found elsewhere. The sections are those of a small spindle cell sarcoma.

### ECTOPIC PREGNANCY

DR. M. T. GOLDSTINE: The patient had a primary and a secondary rupture, the pregnancy continuing until about the fourth month, when I operated. The placenta was well developed and had attached itself to all the surrounding organs. It apparently received most of its blood supply from an attachment to the omentum. The section shows the chorionic villi. The patient did well after the operation.

The second specimen is one of spontaneous miscarriage of a twin pregnancy with both sacs intact. One sac was ruptured after delivery, the other was intact and contained a fetus.

### FIBROID OF THE UTERUS WITH SEVERE HÆMORRHAGE

DR. ROBERT T. GILLMORE: Report of case Mrs. X., married. 43 years of age. White Occupation, housewife.

History of the present illness: November 8, 1911, the patient had such a profuse uterine hæmorrhage that she fainted ten or fifteen times before the hæmorrhage finally stopped. Four days afterwards I saw her in consultation with Dr. James. She was so weak that she could only move with assistance. There was a marked yellowish pallor of the skin. The hæmorrhage had stopped and aside from a slight nausea there were no other symptoms.

Past history: During childhood she had some of the children's diseases, but could not recall what they were. She had had three miscarriages from ten to eighteen years ago with good recoveries without operation. No children. Ten years ago she was told that she had a submucous fibroid and an operation was advised. She was

curetted and there was some improvement in the hæmorrhages of which she had complained for about six months after the operation.

Menstrual history: She first menstruated at 12 years of age, 28-day type, five or six days duration, and not painful. Six years ago it was of the 28-day type, duration 7 days, and painful. For the last year the duration was from seven to eight days, ten to fifteen days apart and about every other menstruation was quite profuse.

Family history: Her father died at 69 years of age, cause unknown. Mother died at 47, of pulmonary tuberculosis. One sister living and well. Her mother's brother had tuberculosis, grandmother on her mother's side had a fibroid tumor of the uterus, and her aunt on her mother's side had a fibroid tumor of the uterus.

Examination: Patient weighed 170 pounds, with a yellowish white appearance of the skin. Mucous membranes white; pulse 130, regular, of good quality. Temperature 98°; heart and lungs normal, urinalysis negative.

Pelvic examination: Bimanual examination demonstrated uterus anterior freely movable, slightly irregularly enlarged, hard and nodular, four and one half inches in length. Diagnosis, uterine fibroma.

Treatment: Patient was given plenty of fresh air, rest in bed with nourishing diet. For the control of the hæmorrhage, cotarine hydrochlorate 1 gr. hypodermically, 3 times daily. An operation advised as soon as her general condition would justify, with special care at her next menstrual period so there would not be a recurrence of the uterine hæmorrhage if it could possibly be avoided. She was sent to the hospital December 10th, about one month after I first saw her.

Her blood count: Reds 4,000,000, leucocytes 6,000, hæmoglobin seventy per cent. She was still weak; was unable to be out of bed. By about December 22nd, she had regained considerable physical strength, was up and about with the

signs of another menstruation commencing. December 24th, she was given scopolamine and morphine, followed by an ether anæsthetic, and supravaginal hysterectomy was performed and her appendix removed. The only difficulty in the operation was that the oozing was controlled with difficulty. She made an excellent recovery from the operation and at present is in good health and able to attend to her household duties.

**Pathological specimen:** Macroscopically the specimen presented was a multiple fibroma of the uterus. The length of the uterus four inches; irregular, with four fibroids, two submucous, one intramural, one cervical, color white, no evidence macroscopically of any secondary change.

**Conclusions:** This case illustrates: First, the slow growth of a large number of uterine fibroids, the clinical evidence showing it must have been present ten or twelve years, second, a fact generally conceded, that is, the nearer the tumor is to the endometrium the greater is the hemorrhage, being probable that this submucous tumor was the cause of her severe hemorrhage; third, the submucous tumors were not larger than hazel nuts, which would demonstrate that the size of the tumor has no relation to the severity of the hemorrhage, deaths having been reported from submucous tumors one-quarter of an inch in diameter; fourth, in obscure uterine hemorrhages the interior of the uterus should be explored with the finger, it having been previously dilated with tupelo tents.

#### DISCUSSION

**DR. H. F. LEWIS:** The question arises whether we should remove the entire uterus in these cases. When we do not examine histologically, there is a probability of leaving some surface which may contain malignant cells. Shall we do a complete hysterectomy or a subtotal operation?

I was led to this thought, particularly by a case that occurred recently where there had been a fairly large fibroid in a maiden woman of sixty. There had been a supravaginal hysterectomy done about six months before. It fell to me to take care of her until her death, which was caused by a carcinoma of the cervix. There are more carcinomas in fibroid uteri than in the others.

**DR. T. J. WATKINS:** Where there is any suspicion of the cervix being diseased it is best to do a complete hysterectomy. Most of the men who speak of removing the cervix say that it is a trivial affair. It only takes five minutes longer. From my own experience I am impressed with the fact that a complete hysterectomy takes about twice as long to do as a partial hysterectomy. Every man who does the complete operation will occa-

sionally get some annoying bleeding in the base of the broad ligament, or have a ligature break, or a vessel contract. It would seem to me that no one is justified in doing a complete hysterectomy in preference to a supravaginal hysterectomy without some pretty definite indication. The operation is more severe, and there is more danger of accidents, such as injuring the bladder or ureter.

**DR. EMIL RIFS:** I do not agree that an abdominal total hysterectomy is much more of an operation than a supravaginal amputation. I do not agree with the many statements made that there are such large numbers of fibroids that undergo malignant degeneration and that therefore every fibroid should be treated as a malignant tumor and be removed as radically as possible.

Many fibroids have been declared to be on the border line between sarcoma and fibroid. Every expert pathologist whom I have consulted about these cases refuses to make a positive statement. When you have a fibroid rich in cells, cells with much more protoplasm than usual around the nuclei, and the rest of the tumor shows a perfect capsule and no invasion of the surrounding tissues, it is hard to prove that there is any malignant degeneration.

The idea has gained ground among practitioners generally that every fibroid is extremely liable to undergo sarcomatous degeneration. I cannot find that in my own experience at all. I make it a rule to take a piece out of every fibroid that I remove, taking a piece that looks most abnormal, and make sections. I have had two sarcomas of the uterus in the fifteen years that I have been in this city, and those did not look like ordinary fibroids at all. They were plain sarcomas. One of the patients is dead from recurrence, the other I have lost track of completely.

As to the frequency of carcinoma in fibroid, why do we hear so much of that? First of all, uteri which we take out for fibroid can be examined, and we can find the carcinoma when there is one, and of the uteri which are not taken out, we do not know whether they contain a carcinoma or not. I have operated on over one hundred and eighty fibroids, and I never saw one that afterwards developed carcinoma in the cervix when I left the cervix. There are many total hysterectomies in that group of cases, however. If any one else has seen a case of carcinoma in one of my patients, I would like to hear of it.

As long as we do not know more of the origin of cancer than we do, I would not be willing to accept the statement that fibroids have anything to do with the origin of carcinoma.

DR. GILLMORE (closing): In my case we had to consider the fact that the patient could not bear an operation very well because of the shock due to the loss of considerable blood, and it was difficult to get her into shape for an operation; and even then there was considerable oozing which it was difficult to control, and it was not advisable to prolong the operation even for a short time. Of course, when we are speaking of operations that can be done on patients in better physical condition, we can take out the cervix. I would not do it because I do not believe that the percentage of cancers would justify one in doing that operation, if it adds anything at all to the mortality.

#### DEATH FOLLOWING HEBOSTEOTOMY

DR CHAS S. BACON: The patient was a primipara between twenty-six and thirty years of age. Three or four years ago she had a long illness of obscure origin and nature for which, after a considerable course of treatment, she was sent to a hospital for several weeks. She was turned over to the gynecologic service. A laparotomy was done and the appendix removed because of chronic inflammation. She was never well after this illness.

I saw the patient yesterday after she had been in severe labor for 40 hours. The labor began four days before the operation with a few pains and rupture of the membranes. When I saw her she had pains lasting from a minute to a minute and a half, with an interval of less than a minute. The child was in serious condition, heart tones running between 80 and 120. Patient had a temperature of 100.8. The pelvis was flattened, the conjugata vera I estimated at 8 cm., the diagonal being a little below 10. The cervix was dilated to nearly half. The head was in the inlet and some molding was beginning. The occiput was to the left; the sagittal suture transverse and the large fontanelle to the right. It was nearly a bregma presentation. The bladder was very much overdistended, efforts to catheterize had failed. I could push the head out of the pelvis to some extent with some trouble. The urine when withdrawn was somewhat bloody.

It seemed doubtful that the woman could bear the child spontaneously. The only operations I could consider were hebosteotomy, or extra-peritoneal section, which I had never made. This was my fourteenth hebosteotomy and all the mothers and children had been saved, consequently I preferred that operation. The vagina was rather small; the vulva did not admit the hand, so I made an epysiotomy on the left, ex-

tending the incision up into the vagina two or three inches. Bleeding was free and necessitated the clamping of some vessels. The cervix was cut anteriorly and posteriorly, two and three inches respectively. The bone was cut subcutaneously on the left side in the usual manner, and with less hæmorrhage than usual. The head was pressed into the pelvis after the separation of the bones to about 5 cm. The forceps were applied and the child extracted. It was somewhat asphyxiated but was easily revived and lived.

I sewed up the incisions in the cervix before the removal of the placenta, which I always do. I found a tear on the left side of the vagina extending to about two or three cm. of the cervix. This I repaired and also the incision on the right. There was not much hæmorrhage. The placenta was then expelled. A hot douche was given and a bandage applied around the pelvis. The patient was put to bed. The report from the anæsthetist was that the pulse had remained the same throughout the operation, about 120, but that it was a little weaker toward the end of the operation.

After I had attended to the baby, I returned to the mother and found her having some difficulty with respiration and the radial pulse was not very good, about 120. I gave her 600 cc. of salt solution and one-third grain of morphine in two doses, which I have found to be very valuable in these conditions. The pulse improved and I left the patient. A few hours later another injection of salt solution was given. At seven o'clock in the evening she became worse, and died shortly afterward, about seven hours after the operation.

A postmortem examination was not permitted so that I cannot give the cause of death. Of course, I would think of rupture of the uterus, embolism, concealed hæmorrhage and shock. I do not think that air embolism can be considered. If rupture did occur, it did not extend through the cervix, and the placenta was in the uterus until the end of the operation; the uterus remained hard and firm all the time. Concealed hæmorrhage could hardly have occurred from the uterus although there may have been a hæmorrhage from the bone. There was no evidence of hæmorrhage during the repair. It was probably simply shock in a woman with an injured heart due to previous infection, from the long labor, the operation and the anæsthesia.

#### DISCUSSION

DR. CHANNING W. BARRETT: This will probably go on record as a death due to the hebosteot-



omy, although Dr. Bacon does not claim it to be such. Bad results are not due to the operation, but to delay in operating. This patient did not bleed much, although she had been in labor a long time and there was reason for her being exhausted. Then there was the incision into the vagina and some hæmorrhage from that.

As to whether a hebstectomy should be performed on a primipara, I have been rather careful to massage the pelvic floor and dilate thoroughly before doing the operation, as we would do for a preliminary forceps operation, getting a good dilatation first. After doing that I have sometimes had no trouble whatever. But the operation is justifiable even in a primipara, when the patient has been in labor so long that Cæsarean section is not desirable and yet a living baby is to be delivered.

OVARIAN TUMOR COMPLICATING PREGNANCY, DELIVERY AND PUERPERIUM. — DR. CHANNING W. BARRITT'S PAPER APPEARS IN THIS ISSUE. (SEE P. 28.)

#### DISCUSSION

DR. CHAS. S. BACON: Dr. Barrett has made out a strong case in every respect but one. There is no doubt that the tumor grows in size in the majority of cases, and that it is apt to become twisted. Why that should occur during the pregnancy is not clear except it be that when the uterus is raised up out of the pelvis it displaces the tumor and gives it greater mobility. The results show that there is no question as to what should be done. As a rule, as soon as the tumor is discovered it should be removed.

The first question is, have we a tumor or simply an enlarged Graafian follicle or an enlarged ovary with numerous Graafian follicles. That will require careful study, as seen by the history of a case which I will give in brief. I once attended a woman during labor. After the labor I noticed a small mass at the side of the uterus. It decreased somewhat in size during the puerperium and it did not cause any trouble. At the next pregnancy, three or four years later, the tumor became very large and had to be removed. Even when I had the opportunity of studying this tumor after the first labor I still was in doubt as to its nature, so much so that I did not operate. Its nature could have been determined much less easily during the first pregnancy.

The only instance where I would have any doubt as to operation during pregnancy is in double tumor during the latter months of pregnancy. During the sixth, seventh and eighth months of pregnancy there is a greater tendency

to abortion after operation. Supposing a woman has a double tumor, and this means that this is probably her last pregnancy. Here is a case where one might prefer to wait, in the absence of serious symptoms, at least until the ninth month or even until after labor.

The point on which I would be inclined to differ with Dr. Barrett is the method of treating the tumor during labor. I believe that it is seldom that one cannot remove the tumor from the pelvis. If it is an obstructing tumor, and the head is not much engaged, it can be pushed up out of the way, the tumor displaced, and labor can proceed. Two or three days afterward the tumor can be removed.

DR. RUDOLPH W. HOLMES: I have had some six ovarian cysts in an obstetric relation, besides a very considerable number of small ones which were of no significance.

The first one was a patient upon whom I had to perform a Cæsarean section after hours of obstructed labor, and where repeated examinations had been made by the various consultants. The cyst was equal to the size of a man's head, was firmly adherent to the cul-de-sac, and almost completely filled the pelvic brim. The baby was alive at the time of operation, but unfortunately was not resuscitated from its condition of apnea. After removing the child the cyst was removed with considerable difficulty, on account of the dense adhesions. The woman recovered. The next case I saw in consultation, the cyst held nearly a gallon of fluid, and was easily removed. The other ovary was normal. The woman completed the remaining four months of her pregnancy, and completed her primiparous labor spontaneously; some six months later she returned, presenting the appearance of a six-months pregnancy; a cyst of the ovary was removed equaling the size of the former cyst. She recovered.

The third case was interesting not because of the size of the cysts, but from their location and adherence to the cul-de-sac. The woman came to me with a history of a confinement some eighteen years previously; some ten years ago a member of our society advised the removal of both ovaries which were causing considerable distress. This was refused, and she then took local treatments from another physician fairly consistently until she came to me in her pregnancy. I found both ovaries enlarged to the size of lemons or larger, and firmly lodged in the cul-de-sac. With the advance of pregnancy the tumors were elevated to the brim, carrying the posterior fornix upwards. My advice was that these tumors should be removed on account

of their influence on labor. The recommendation was rejected. As the time of labor approached the head was found eccentrically placed, abnormally movable even for a parous woman. At this time my conviction was strong that the woman's interests would be conserved as well as the baby's life safeguarded by an elective Cæsarean on these grounds: while the woman did not possess a contracted pelvis, yet it was a low normal, the tumors still to a considerable extent held the head out of the brim, the danger of their rupture would seriously compromise her health if not her life, finally the necessity was fairly definite that operative interference would be indicated to terminate the labor, with its risks to her and the child. My feeling is still strong that a conservative section with the removal of the tumors was less hazardous than the operative obstetric delivery with the later removal of the cysts. Labor occurred, for hours the head remained above the brim; at each examination the cysts were palpable. Finally the necessity arose for terminating the labor; high forceps were applied, with the descent of the head the tumors disappeared. The child was alive just before the instrumentation, but was born dead, death being due to a short cord, not six inches long, with a true knot drawn tightly which had cut off foetal circulation. For days the woman suffered only as a laparotomy patient suffers who does not do well, she had excessive nausea, distressing gas pains, with a tympany distending the abdomen to the limit. Examinations failed to find the tumors. A consultant failed to find a vestige of the tumors. Some months later the patient fell into other hands. This physician failed to find anything wrong in the pelvis, likewise a consultant called by him. However, over a year and a half after her labor the abdomen was opened, and the pelvic findings corroborated the pathologic condition pictured by me.

Last year I removed a dermoid of the ovary from a woman in her third month of pregnancy, she went to term and was delivered of her child spontaneously.

Then I saw in consultation a woman in her puerperium who had severe crises of pain in the puerperium which were interpreted as appendiceal; her blood count was over twenty thousand. The pain wandered over the abdomen, and a resistance was palpable over the center of the painful area. On opening the abdomen, a cyst the size of the foetal head was found with a double twist of the pedicle. The fifth case was an infected ovarian cyst in the puerperium which I

removed after the subsidence of the acuity of symptoms. She recovered.

I would lay stress on these points; (1) it is not always the large ovarian tumor which causes the most difficulty in the obstetric relation; (2) a large tumor may remain above the brim and cause no symptoms, while a small one may be adherent in the pelvis, offering sufficient obstruction to prevent a safe delivery; (3) a small tumor, especially in the puerperium, may become infected as readily as a large one, (4) while the large cyst is more prone to torsion of the pedicle, still a small tumor may meet this fate.

#### SUDDEN DEATH DURING PUEPERIUM

DR. FRANK LYNCH: A woman, 33 years of age, in her first pregnancy, passed through it in a normal way, except for a skin eruption, the result of an intestinal toxæmia. She came into labor November 10th, passing through a fairly normal labor of ten or twelve hours' duration, the first-stage pains not being hard. On internal examination the membranes were ruptured. When she came into labor there was a slight trace of albumin, and also after the labor. She passed into an apparently normal puerperium. On the third day her temperature was 100; pulse 116, and after that, except for a rise which three times passed the 99 line, there was no elevation of temperature of more than half a degree.

She got out of bed on the tenth day. Her pulse on the seventh day was 100, only twice was it in the nineties. She sat in a chair for half an hour. On the second day she took a few steps, and on the third day she walked around a bit, urinated on the toilet. She complained that she was short of breath, had convulsions, and died in five minutes apparently of an embolus. The pulse apparently had been normal for some days.

It was my first experience with such a case. The blood pressure ran between 85 and 95; it was never over 100.

DR. BARRETT (closing the discussion): One point that Dr. Bacon made was that in a case where there was no probability of another pregnancy, the case might be continued with the hope of getting a live baby. The answer for that would lie in the decision as to which gives the least child mortality, an operation that is uncomplicated, or in letting the woman carry the tumor and the child to the end of the pregnancy. I find that about 18.8 per cent of women abort without operation, if treated expectantly. In the cases that have been operated about 19 per cent of children have been lost from all causes, but the large percentage of these were due to

the same thing that caused the abortion in others. The damage was done previous to the operation. On the other hand, immediate operation will save some of the women from aborting. So that the figures would indicate that the woman stands a better chance of going to term with the tumor out of the way than with it present.

In regard to the varying degree of danger resulting from the fact that the tumor is large or

small, fixed or movable, I would say that the figures show that they may have occurred probably with a small tumor as well as with a large one. They may go along fairly well or have trouble with a fixed tumor as well as with a movable tumor. The freely movable tumor often becomes twisted, but it does not need a fixed tumor then to make trouble. The only case of twisted tumor I had was a perfectly free tumor

## THE WASHINGTON SURGICAL SOCIETY

REGULAR MEETING HELD JANUARY 19, 1912, WITH THE PRESIDENT, DR. VAUGHAN, IN THE CHAIR

Present: Drs Wellington, Hagner, Van Rensselaer, Balloch, Hooe, Carr, Bovée, Lehr, Fowler, Parker, H. H. Kerr, Magruder, Riggles, Young, Stone, Erving, Fuller, Magee, Sprigg, and Mitchell. The minutes of the previous meeting were read, corrected and approved.

The President named Drs Van Rensselaer, Hooe, Parker, Magruder, and Lehr as a nominating committee. The committee reported the following nominations for the officers for the ensuing year: President, Dr. W. P. Carr; Vice-Presidents, Dr. I. S. Stone and J. Wesley Bovée; Councilors-at-large, Drs. Vaughan and Balloch; Secretary, Dr. Reichelderfer; Treasurer, Dr. H. H. Kerr.

Pathological specimens: Dr. VAUGHAN presented a specimen consisting of 18 inches of lower bowel, including sphincter, the last 4 inches of the specimen being cancerous, the case was a lady, 60 years of age. Dr. Stone removed the uterus 16 years ago, for fibroid tumor. One year ago she began to have pain and discharge. The growth was easily felt and caused almost complete obstruction. Sigmoidostomy was done on left side, the bowel cut and upper end anchored. Three weeks later laparotomy was performed, the rest of the colon dissected down, vessels ligated, glands removed from sacral promontory, the peritoneum and bladder being dissected up. The operation was completed by the vagina; there was no hemorrhage but patient died in 48 hours. This method of operating has been variously named, but is best described as the "combined" operation.

He reported a second case of a boy of 20, who for years had had more or less rectal bleeding. For several months past had gone down hill and lost much weight. A mass could be felt 2 or

3 inches above anus, which would barely admit the finger. In this case an incision was made in the perineum to the left of the anus and the rectum separated for 4 or 5 inches. Further progress was impossible from below, and the complete separation of the bowel was secured by laparotomy. The operation was resumed by the perineal route and a section 4 inches long was pulled down and removed, leaving a lower portion 1½ inches long containing the sphincter. The bowel was sutured, and gauze drain inserted along bowel. The bowels later moved easily and freely and so far the patient had done well.

In discussion, Dr. BALLOCH especially commended the combined method of removing rectal growths as being vastly better than other methods advocated, especially the Krache operation, though Krache advocates the preliminary laparotomy, the combined operation offers better facilities for inspection and removal of glands, etc.

Dr. BOVÉE approved the combined method, working from above first. It is very desirable to preserve the sphincter, if this cannot be done, it would be just as well and easier to perform a colectomy.

Dr. H. H. KERR asked if the case could possibly have been one of diverticulitis, as the mucous membrane seemed quite normal and the age of the patient only 20, but Dr. VAUGHAN called attention to ulceration present and stated that there was glandular involvement.

Dr. H. H. KERR presented a specimen of epithelioma of the anus he had removed from a man of 65. There was a cauliflower mass in front of the rectum evidently from the musculocutaneous margin. The inguinal glands were involved. The mass was dissected up from the

perineum, the sphincter and levator muscle removed and normal bowel brought down into the wound. The fascia to the side from the gluteal muscle was transposed to serve as a new perineal base; he expects later to dissect out any involved glands.

Dr. BOVÉE, in discussing Dr. Kerr's case, believed it would have been better to have done the laparotomy first and thus the affected tissue nearest the vital organs removed first, thus lessening danger of further spread.

Dr. LEHR reported a case of a man who had painful and frequent micturition, especially in the day, for two months there had been some pain and blood at the end of micturition, the pain being referred to the end of the penis. The first glass of urine was cloudy and the second contained some blood. The symptoms pointed to probable stone, but cystoscopy showed a papillomatous mass at the trigone involving both ureters. Dr. BOVÉE said a papilloma might float into the urethra and cause pain and bleeding at the end of urination.

Dr. HAGNER stated that the case of removal of the bladder and implantation of the ureters which he had reported at the last meeting had lived 2 weeks; there was plentiful secretion of urine, but symptoms of pyelitis developed. There was also marked stinging and burning from the urine passing through the bowel and anus. He had decided that he would never again use bowel implantation, as drainage into the back had so much to recommend it. Dr. BOVÉE said that such irritation was the rule, Fowler and Peterson both describe it, there is frequent emptying of the urine from the bowel, though toleration is gradually established and the urine may be retained to 3 or 4 passages a day in some cases. Dr. FOWLER mentioned a case of urethrorectal fistula where there was little scalding or pain in the bowel.

Dr. FOWLER reported a case of stone in the kidney presenting the ordinary symptoms in which the stone was removed two years ago. Last summer some symptoms reappeared and the X-ray showed another stone which was easily removed. The urine had showed no alteration from the second stone. The point of interest was the recurrence of stone in the same kidney pelvis without urinary changes, an occurrence which he thought must be rare. Dr. BOVÉE said that Cabot reports several cases of operation for recurrent stone in the pelvis and ureter, but whether with urinary infection or not he did not know.

Dr. BALLOCH reported an unusual case of hernia, of which he exhibited a photograph.



Photograph exhibited by Dr. Balloch

"This case is reported for two reasons: first, because it is the largest inguinal hernia I have ever seen in a woman, and second, because, in spite of its size and long duration, there were no adhesions whatever, an unusual occurrence in such an old and large hernia. The absence of adhesions may be accounted for by the fact that the patient had never used any retentive apparatus nor had she ever made any applications to the hernia.

"The patient was a colored woman, 52 years of age, who entered Freedmen's Hospital, January 8, 1912. She was a laundress by occupation. Family history negative, so far as concerns the hernia. The principal item of interest in her personal history is the fact that she has had ten children, the last one having been born in 1900. Her labors were always difficult, lasting two or more days. She has always been attended by a midwife and no instruments were ever used to hasten delivery.

"The hernia was first noticed in 1897. It began as a bulging in left inguinal region, accompanied by slight pain. The bulging increased in size slowly, as did the severity of the pain. At times she would reduce the hernia, but it would return shortly afterward. Even in the recumbent position it would not go back spontaneously. In 1909 the pains grew worse, radiating over the entire abdomen and only relieved by vomiting. Has always suffered from obstinate constipation, the bowels moving only when a cathartic was taken.

"Examination shows a poorly nourished woman. Abdominal walls soft, showing linea albae. Abdomen rather scaphoid. From left inguinal region hangs a pendulous mass, 25 cm. in length and 12 cm. in its largest diameter. The mass is continuous with the left labium majus and reaches nearly to the knee. Peristaltic waves are visible and purring is heard when the mass is manipulated. Upon percussion waves of tympany are detected. When the patient lies down the entire contents of the tumor can be returned to the abdominal cavity through the left inguinal ring, which is 6 cm. in diameter. Diagnosis, left inguinal hernia, containing gut and omentum. On account of the reducible nature of the contents operation was advised.

"Operation, January 12, 1912. The ordinary hernia incision was made. The sac, when opened was empty, there being no adhesions either of gut or omentum to the sac or to each other. The sac and redundant skin were cut off together and the wound closed in the usual manner. Healing aseptic and convalescence uneventful."

Dr. MITCHELL, in discussion, mentioned a case of hernia in a man, with an enormous sac reaching nearly to the knee; he had refused to operate unless the man would consent to hunt and thus endeavor to make enough room in his abdomen to receive the contents of the hernia. He does not think operation feasible in many of these extreme cases.

In discussing Dr. Balloch's case, "Dr. Stone reported a case of double inguinal hernia in a female, in which the patient, an intelligent woman of 69 years of age, made strenuous efforts to prevent the formation of a dependent hernial sac.

She began by wearing trusses of various kinds but these failed and she was compelled to rely to abdominal support by firm bandages. The result was an upturned or deflected hernia, which on the right side reached the umbilical level but was outside the external ring and therefore under the skin. On the left side the hernia was much smaller but precisely similar to that on the right. The patient had carried the hernia for over twenty years and finally she began to have symptoms of bowel obstruction and necessitated an operation for immediate relief. On the right side the greater hernial mass was non-adherent in the upper part of the hernia, which was of more recent formation. The upper or lower portion of the hernia was confined in a separate peritoneal pouch and the bowel was firmly adherent, and occlusion was so marked that we were compelled to either resect or make an anastomosis to secure relief from the obstruction. The latter course was elected, thinking to save the patient. The bowel was finally returned and the patient recovered. The larger sac was not adherent to the fascia or fat about it, neither was the bowel adherent within the sac. The pressure of the hernia had produced an adventitious sac around the larger hernial sac, which consisted of condensed connective tissue from which the fat was largely removed. At a subsequent operation the hernia on the left side was closed and the patient is now apparently in good condition."

Owing to the lateness of the hour, the Society voted to defer the reading of Dr. Fowler's paper to the February meeting. The Society then adjourned.

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD MAY 3, 1912, WITH THE PRESIDENT, DR. FREDERIC A. BEESEY, IN THE CHAIR

DR. SAMUEL C. PLUMMER read a paper entitled "Dystopic Kidney."

### DISCUSSION

DR. F. R. LECOURT: Dr. Plummer has covered the subject so thoroughly that there is very little to say about these misplaced or congenitally dystopic kidneys. It is a subject very well understood, and I am sure that many of the surgeons here have knowingly or unknowingly exposed

these kidneys, and some of you have unwittingly cut into them and have been compelled to remove them later.

One point I would like to emphasize is that the ureters open in the usual position normally in the bladder. I would like to lay stress on the frequency of malformations in women, at least with the genital organs. This is of clinical importance. The case Dr. Plummer had of crossed dystopic kidney without any fusion of the two

kidneys is of extreme rarity. A dystopia that is crossed and with fusion, as he has mentioned, is not so common, and has been called, as he has already stated, sigmoid kidney. I have brought with me a specimen of that kind of tissue.

I would like to emphasize again what he has already mentioned, that in these cases where the kidneys are both on one side, the lowermost kidney or the kidney that is in front of the other, in case they are overlapping at all, that kidney is very likely to have the ureter and vessels in front.

There is another point of interest to you clinically, and that is that where the dystopia is not crossed the misplaced kidney is small, like the specimen shown you. It is a small kidney and may be removed without any particular danger if there is another kidney, and there is usually another kidney. These are all the points that I would like to mention.

I have here a specimen that has not yet been mounted which was recently removed from the body of a man who died from something connected with the kidney, and it is an example of the so-called sigmoid kidney where the kidney is fused, but not in a horseshoe way. It is fused in such a way that the kidneys both lie on the same side of the body. The fusion is at the upper end of the misplaced kidney. This sigmoid kidney is not as rare as the example of Dr. Plummer's of dystopic kidney without fusion.

DR. L. L. McARTHUR: It would be futile for me to rise to discuss a paper which embodies in itself all that is known on this subject or to be found in the literature, but notwithstanding the fact that only one such specimen is found in a thousand post-mortems, it has been my fortune to meet with three such kidneys in my operative experience. Two of these are already incorporated in the list of eighty-four cases which the essayist presents, and I rise to add to these a third case which presents so many of the difficulties which attend both the diagnosis and the handling of such cases, that I think it worth while to briefly summarize it. I have on one other occasion referred to the case, but would like to have Dr. Plummer add this to it. It occurred four years ago in the case of a young woman who was contemplating marriage, and prior to that she desired to be sure that she was a healthy woman and to learn what it was that was causing pain in her lower abdomen. She called my attention to a mass there. This mass lay in the middle line below the umbilicus in front of the last lumbar vertebral body. The mass was tender on pressure, was painful at the menstrual period more than at other times, and seemed to be quite im-

movable. It could neither be moved up nor down, nor could it be moved from side to side. It seemed from physical examination to be an outgrowth from the body of the last lumbar vertebra or promontory of the sacrum. Vaginal examination both by myself and confrères made us sure that it was in no wise connected with the genitalia. All forms of examination were instituted, even the X-ray failing to show what we thought possible from a clinical point of view might be a sarcoma of the body of the vertebra or a bony outgrowth from the bodies of the vertebrae. Any shadow here which the kidney might cause in this position could scarcely be interpreted as a kidney picture, and would therefore not aid in the diagnosis which the essayist suggests. Believing it to be a serious enough affair to justify exploratory laparotomy, I opened the young girl and found to my astonishment that I had to deal with a dystopic kidney which was in my opinion a horseshoe kidney that was dystopic, and the isthmus of the horseshoe was right across, followed around and rested upon the last lumbar vertebra. But on introducing the hand into the pelvis I could feel on each side of the pelvis a typical kidney-like body which could be lifted almost out of the true pelvis, or taking the opposite side it would reverse the see-saw movement. Until to-night I had forgotten that I ever knew that the kidney develops in the lower pelvis and reverses the direction of the testicle, it ascending and the testicle coming down. I thought that I must do something to correct the position of the kidney and therefore sought to find if the ureters of this kidney were long enough. I thought, of course, the vessels would be long enough because I imagined the kidney had descended from above. Searching I found both vessels of the ureter from there were very short, and that the kidney or kidneys that were fused took their origin from the internal iliac artery, got their vascular nourishment in that way, and the ureters appeared to be short. I was then confronted with a peculiar situation. The young girl, who wanted to be married, with two kidneys fused together down in her pelvis, sought my advice. It seemed sure in that position the kidneys would be so compressed as to make a fatal uræmic poisoning, as was reported by the essayist in one case, from the uterine pressure, and the question arose whether I should ligate the tubes and make the woman sterile. This I had neither her permission nor did I think of it before operating, and so was obliged to close the incision without changing the situation of the kidney, finding the vessels so short that it made it impossible to

divide the isthmus and slip that out of the pelvis, and I had no right to sterilize her. The question then may present itself to any one of us again, and in the discussion of this paper by the society I would like to ask what their procedure would be under such circumstances were they to meet with such a case, and I do not feel ashamed that in this case, as in twenty-five per cent of the cases collected, the operation only revealed the nature of the trouble, the diagnosis not having been made before.

DR. FRANCIS J. SHEPHERD, Montreal. I have seen a good many cases of misplaced kidney. Before a disastrous fire occurred at our medical building in Montreal, I had a dozen examples which I had collected from post-mortems and the dissecting room in thirty years, and I not only found displaced kidney was on the right side in my cases, but on the left, as Dr. Plummer has said, and always discoid. The kidney is between the two common iliacs. I do not think the explanation given of the blood supply is satisfactory at all. I have one specimen in which there are seven or eight arteries going into the kidney, none into the hilum, in one case one superior mesenteric, and the other from the common iliac coming from each pole of the kidney, none in the hilum, and the hilum is not misplaced, so that I do not think the explanation given is satisfactory.

DR. CARL WAGNER: I removed a kidney last fall from a young man, thirty-five years of age, who presented himself with an enlargement on the right side near Poupart's ligament, but a little farther up. He had symptoms of pain, and this pain was so severe that he doubled up during his work. In this case we thought we had to deal with an appendiceal abscess. We found a square shaped kidney with the hilum on top, with the tip of the growth under the artery which came directly from above on the outer quadrant. We removed the kidney and the patient made a good recovery.

DR. DANIEL N. EISENDRATH: I think Dr. Shepherd possibly may have misunderstood the idea which Dr. Plummer tried to convey. What Dr. Plummer tried to convey was that these dystopic kidneys received their blood supply from the vessel which just happens to lie in close contact with the relatively congenital position of the kidney.

There are several interesting points from a surgical standpoint that we can discuss intelligent-

ly. In the first place, these kidneys are very fixed. That is a matter of great surgical importance, because it makes such a kidney extirpation an exceedingly difficult operation, not only where there are multiple arteries, but where there is fixation of the kidney. Then, too, the very fact that the hilum invariably points forward complicates matters. It also accounts for the fact of the greater number of these kidneys—I think eighteen out of sixty-seven were hydronephrotic or pyonephrotic. We see the same condition in the horseshoe kidney, and the hilum being forward, it frequently happens that the ureter passes across the front portion of the kidney, in place of taking the usual route, and in that way it favors obstruction of the kidney with resultant hydronephrosis.

From the standpoint of nephrolithiasis, I have had occasion to make quite a study of the relation of dystopic kidney to the subject. Let us assume this (indicating on the blackboard) to be the twelfth rib, and these the first, second, third and fifth lumbar vertebrae. I have made it a point, where I see a kidney shadow which I do not suppose, without special examination, is due to a shadow in the ureter, to think of the possibility of this being a shadow of a kidney stone in a dystopic kidney. I have seen quite a number of cases in which the main shadow was located about opposite the fourth or third lumbar vertebra in the pelvis of the kidney. It is the abdominal form of dystopia in which the kidney lies somewhere close to the iliac crest.

The second variety, the abdominal pelvic variety, presents a typical calculus like a sacro-iliac joint. That is typical for a calculus in a dystopic kidney of the second variety.

We have a third variety where the kidney lies in the pelvis proper. If we suspect from our X-ray studies a dystopic kidney, there is only one way of determining it, and that is by the method of injecting collargol solution and taking pictures. If we see a shadow which we do not think is the shadow of a ureteral calculus, we should make it a point in every case to take an X-ray and with the wire bougie in place. To add to Dr. Plummer's collection of dystopic kidneys, I will say that there was published in the *Presse Medicale* for 1898 a case of pyonephrosis in a woman, fifty-five years of age, in which the kidney was found within the layers of the mesentery, so that this makes the second case of dystopic kidney in addition to the one Dr. Dawbarn has reported.

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 17, 1911, WITH THE PRESIDENT, DR. CHARLES E. PADDOCK,  
IN THE CHAIR

## FATAL HÆMORRHAGE SIXTY HOURS AFTER LAPAROTOMY

DR. THOMAS J. WATKINS: The hæmorrhage in this case took place between the fascia and peritoneum. Twenty-four hours after the operation the patient complained of a great desire to have a bowel movement. At the end of forty-eight hours she was still complaining of great abdominal distention. Examination of the abdomen failed to show much distention. Cathartics were given the second morning but produced no result. In the afternoon the nurse massaged the abdomen. It occasioned much pain, the patient passed much gas and rapidly grew worse.

I saw her about fifty-five hours after the operation, at 10 P. M. She had an immense blood clot which dissected the peritoneum off on either side to the muscles of the back. Percussion showed a very distinct tympany all over the abdomen. The pressure had torn the peritoneal sutures and there was much blood in the peritoneal cavity. Yet this gave no dullness in the flanks. The hæmorrhage had come on so gradually that there were none of the usual signs of hæmorrhage. There was not as much pallor as one would expect. The bleeding had been slight and absorption was going on all the time.

On opening the abdomen we found a large blood clot. The peritoneum was found stripped off; the sutures had given way and the blood was in the abdomen, but there were not many clots in the abdomen. The original operation was a hysterectomy. The pedicle was normal. We cleaned up as quickly as we could, but the loss of blood was so great that the patient died.

The cause of the hæmorrhage was interesting. The wound was dry; more so than usual. The only possible explanation would be that in suturing the fascia the needle passed through a blood vessel in the rectus muscle and it bled.

I know of one other case of fatal hæmorrhage following the removal of an appendix where the deep epigastric artery was punctured. My patient may have had an anomalous deep epigastric artery or an unusually large vessel in the rectus muscle. It is impossible to avoid such an accident.

DR. CHANNING W. BARRETT: A woman entered the hospital with the history that thirty-six hours before she introduced a crochet hook into the uterus to produce an abortion. She left it in place for a few hours and when she reached for it, it had disappeared. Instead of waiting for peritonitis to develop she entered the hospital at once. I explored the uterus, but found nothing. There was no evidence of pregnancy. We opened the abdomen and found the crochet hook, which had passed through the fundus of the uterus. The opening into the uterus was closed by a piece of omentum which had already become adherent and there was not the least sign of blood in the abdominal cavity. There was a little irritation of the peritoneum from the presence of the hook.

DR. HERBERT MARION STOWE: CASE 1. Mrs. M., age 35 years. Family and personal history negative. The first child was born in July, 1906. Labor lasted thirty-six hours and delivery was accomplished by a difficult forceps operation. The child was dead and weighed 7.5 pounds. The second child was premature and was born normally. This child still lives. The third labor occurred in February, 1909, and was terminated by a difficult craniotomy after thirty hours of uterine contractions. The patient entered my service at Cook County Hospital, December 20, 1910, giving a history of thirty-one hours of futile labor pains. Two physicians had attempted to deliver but failed. The patient was of medium build. Heart, lungs and kidneys negative. Pulse 96, temperature 97.6° F. The fetal head lay over the fundus with the occiput on the left. No obliquity. The heart tones were audible, 138 per minute and regular. The cervix was effaced, the os dilated and the membranes ruptured. The pelvic measurements were I. S. 26, I. C. 30, Baudelocque 19 cm., the internal diameters C. D. 11.5, C. V. 9, Transverse of the inlet 13, bi-ischiatic 10 cm. The sacral promontory projected into the inlet. The leucocyte count at the time of admission was 24,950.

On account of the previous manipulative efforts to effect delivery and the probability of septic infection, an abdominal delivery was rejected. Embryotomy was also excluded as the fetal



heart was audible. A cautious attempt was made to deliver with the high forceps but two strong tractions showed the futility of such a procedure. With the forceps still *in situ*, the Gigli saw was introduced in the left side and the section completed in a few minutes. After the section the head was easily drawn into the pelvic cavity and delivered at once. The child weighed 7 pounds and 12 ounces and breathed in a few minutes. The parturient tract was then examined for lacerations and none found. The uterus was packed and the patient put to bed in good condition. On December 24th, the left leg was swollen and was tender to the touch but no veins could be palpated. The condition subsided rapidly. The patient made an otherwise perfect convalescence and left the hospital on January 12, 1911. This woman was seen by me one week ago and both she and the baby were found to be in good condition. The mother suffered from no disability and was able to attend to her household duties as well as ever.

CASE 2. Mrs. W., age 21 years. Family and personal history negative. Her first child was delivered in October, 1910, after a labor of sixty-one hours. A difficult forceps operation resulted in the extraction of a dead baby. The child was evidently killed by the forceps.

She entered the Cook County Hospital on July 10, 1911, after a labor of thirty-six hours. Several efforts had been made to deliver her and she had been under an anæsthetic for over three hours. Heart, lungs and kidneys negative. The head presented over the inlet in Nægele's obliquity, the occiput being on the right. The head distinctly overlapped the os pubis. The fetal heart tones were 164 and regular though weak. The abdomen presented the usual findings of threatened uterine rupture and Bandl's ring was plainly visible. The cervix was dilated and effaced and the membranes ruptured. Mother's pulse 148, temperature 102.6° F. As the method of delivery in this case lay between embryotomy and hebstectomy, the child was given the benefit of the doubt although meconium had been passing for six hours. The true conjugate of this pelvis was estimated to be 8 cm.

Hebstectomy was done immediately and the child was delivered at once by forceps. The operation was moderately easy. The child was asphyxiated but revived in 15 minutes and lived. Internal examination showed no laceration of the soft tissues but revealed a greatly thinned lower uterine segment. The convalescence was uninterrupted and the patient left the hospital on July 25th, in good condition. This woman was

recently seen and reported herself and child to be in good condition.

#### DISCUSSION

DR. N. S. HEANEY: After you applied the forceps in your attempt at delivery, did you leave them on when you did the pubiotomy?

DR. STOWE: Yes, I left them on.

DR. CHANNING W. BARRETT: The place for a pubiotomy is well defined. It is applicable to just such cases as those reported where the woman has been in labor for some time, is not in good condition for a Cæsarean section, and where there is a living baby. There are those who maintain that Cæsarean section should entirely take the place of pubiotomy, but this cannot be done without including craniotomy, and craniotomy should not be performed on a living child. In these cases pubiotomy gives the mother and child an excellent chance.

I have performed the operation six times with six recoveries of the mothers and five living children. In one case I was called into consultation late, and it was reported that the child was alive just before the pubiotomy. The abdomen was very thick, and although the fetal heart sounds could not be heard we did not wish to take that as evidence that the child was dead. Therefore, we performed the operation, but the child was dead.

Those who have not performed the operation are rather inclined to magnify the severity of the work. The patient has very little pain after the operation, gets up within three or four weeks and begins to walk around. She may have an occasional twinge of pain at the site of the operation but eventually that disappears. One patient complained of pain on moving the leg as when pushing a chair with the toe.

I performed a Cæsarean section a few days ago on a woman on whom I did a hebstectomy two years before, getting a living child, although she had been in labor from Tuesday until Sunday. I had much difficulty in delivering her after the hebstectomy, and I concluded that if she became pregnant again, I would do a Cæsarean section. The pregnancy occurred, the people consented to the operation, and it was done successfully.

DR. FRANK LYNCH: The external measurements of the pelvis mean very little. A difficult labor is sufficient to show that there is a contracted pelvis. But we should emphasize the value of the internal measurements. Text-books err greatly in laying so much stress on external measurements. It is unfortunate that we have

no means of estimating the true conjugate, but when we measure the diagonal conjugate, we have some data on which we can work.

DR. CHARLES S. BACON: We should determine, if possible, whether the child is alive or dead. If the heart sounds are absent, I would favor introducing the hand into the uterus, for the head is not fixed in the pelvis, and finding out whether the cord is beating. But even then one may be in doubt. If the cord is pulsating, however, one is justified in performing the operation. If the child is dead, the operation should not be performed.

There is not much danger connected with the operation, but the disability that sometimes follows is sufficient to make one hesitate when the child is probably dead. It is a safer operation in cases of possible contamination than Casarean section. Infection is a contraindication, but the danger from infection is less in hebosteotomy than in Casarean section.

DR. BURRIEY. In my case the report was that the cord was beating. I repeated the examination, but did not feel sure about that.

DR. CHARLES E. PADDOCK. The operation of hebosteotomy is not devoid of danger, as we are led to think by the remarks made here to-night. The medical literature contains many reports of this operation that have resulted in ruptures of the bladder, failures of the bone to unite, hemorrhages, and even fatal hemorrhage. Still, the operation has its place and also its limits. It is done in the interest of the child, and there must not be too great disproportion between the head of the child and the pelvis. It means also that the woman has been in labor long enough to have finished the first stage. This at times means a serious injury to the baby, and unless the child be in a good condition we would not be justified in doing hebosteotomy. Neither should the woman be infected. In making our diagnosis of the condition of the child, it should usually be made by auscultation and not, as one of the speakers has mentioned, by palpation of the cord, which, I think, in the majority of the cases, would be an impossibility.

I also want to add that I believe there is still a field for craniotomy, and it is in such cases where pubiotomy seems out of the question, even though the child be alive.

#### INTRAUTERINE FRACTURE OF LEG

DR. OTTO H. ROHRBACK: In this case there was evidence of a history of syphilis in the parents. The mother, 30 years of age, had given birth to two children. They are now six and eight years

of age respectively and in perfect health. There was no history of trauma of any kind in this pregnancy. The fetus was easily outlined in the last two weeks of the pregnancy. It was rather superficial, and there seemed to be but little liquor amnii present. When the bag of waters ruptured, little fluid escaped and little escaped during the birth. The examination of the membranes and placenta showed them to be normal—no bands or threads. The baby weighed nine pounds ten ounces. It was normal in every way, except that the lower part of the right tibia was bent at right angles and immediately above this was a discontinuity of the skin which looked like a scar resulting from a healed compound fracture. The external malleolus was absent, the fibula could not be felt, and there was an absence of the outer two toes. The leg was shorter than the other. The Rontgen picture shows an angular deformity of the tibia and entire absence of the fibula and the metatarsal bones of the outer two toes. There was no evidence of syphilis or rickets in the child, nor history of trauma in the mother.

#### CIPHALOCLE IN A CASE OF HEMICRANIA WITH THE PRESENCE OF MOST OF THE SCALP AND THE MEMBRANOUS COVERING OF THE ENCEPHALON, COMPLICATED WITH MESORHINOSCHISIS, PALATOSCHISIS AND SYNDACTYLIA.

DR. CHARLES S. BACON. The child was born spontaneously after a labor lasting thirty-five hours with a face presentation. The mother was a primipara. At the appearance of the first cyst at the vulva, it was mistaken for the bag of waters, which had, however, previously ruptured. The cyst was torn open by the attending physician and the contents escaped. The child cried and was able to swallow but unable to nurse because of the mesoschisis of the nose and palate. After twenty-four hours the cyst which had been ruptured became odoriferous. The child was removed to the hospital but an operation was not to be considered. The head was dressed and the child was occasionally given water to drink and morphin was administered hypodermically to quiet it. It was given  $\frac{1}{8}$  grain and was quiet during the night. The following morning the interne gave it  $\frac{1}{4}$  grain and two hours afterward repeated the dose. Some time afterward he gave still another  $\frac{1}{4}$  grain. The child slept quietly all night, and the next morning it was still alive. It died a few hours later. It was interesting to note the amount of morphin which the child endured.

A post-mortem examination was not permitted.

The cranial vault was practically gone. The base of the skull was present up to the occipital protuberance and the orbit in front. The parietals and the upper part of the frontal and occipital bones were absent. The scalp covered the entire head except where the two tumors protruded. One tumor had a pedicle about the size of the child's neck, arising a little to the right of the median line and above the eye. This tumor was not ruptured. Skin covered about one fourth of it; the remainder was covered by membrane. The pedicle of the other tumor was about one to one and a half inches in diameter. It arose to the left of the median line, probably in the region of the posterior end of the parietal bone. There was also a fissure between the nostrils, and these were closed. There was a slight cleft palate. Both hands, especially the right, were simply clubs; the fingers were not separated.

#### DISCUSSION

DR. CRANE (for Dr. E. G. Beck): I wish to report the case of a child born with a large cephalocele two thirds the size of the child's head. Labor was normal and rapid. There were no other defects. On the eighth day Dr. Beck operated without anesthesia, removing the tumor, which was divided into two parts by a membrane. The membranes surrounding the tumor were ligated and the sac cut off, after pushing back into the cranium the brain matter which was found in the tumor. The child made an uneventful recovery from the operation.

Six weeks after the operation signs of hydrocephalus appeared. The child showed signs of distress, regurgitated food, cried much, was cyanotic, had intervals of rapid breathing and a crowing inspiration. Death occurred about three months after the operation. Withdrawal of a few cubic centimeters of fluid from the hydrocephalus gave temporary relief only.

DR. ARTHUR CURTIS: The question of foetal deformities is an interesting one. Mall has

studied it more thoroughly than anyone else, comprising in his study some six or seven hundred cases. He is of the opinion that amniotic adhesions do not play much of a rôle in the formation of abnormalities of any kind. He believes that there are degenerative processes in the chorion which can be demonstrated macroscopically and microscopically. It is possible that there is some sort of inflammatory process which causes the degenerative changes in the chorion or which may affect the cells of the foetus as it begins to develop and this causes malformation by retarding the growth of the embryo. Failure of development of both arms and both legs makes it difficult to explain the pathologic findings, and yet these occurrences are compatible with the theory of inflammation or toxæmia during the early development of the foetus. The cells which form the upper extremity proliferate most rapidly, therefore are most subject to any irritating process and are destroyed, whereas the other cells go on to full development.

DR. GEO. SCHMAUCH: Surgeons have given up the idea of closing these encephaloceles and meningoceles. They drain and the results recorded in the literature are especially good when the sack in the spina bifida was drained into the peritoneal cavity. If you close up the opening, you do not remove the cause, the secretion of fluid continues and a hydrocephalus is the consequence.

The pulse twenty-five minutes before death was 80.

#### PREGNANCY WITH UNRUPTURED HYMEN

DR. FRANK LYNCH: The woman complained of amenorrhœa, and the husband stated that intercourse was impossible. Vaginal examination was impossible because of the severe pain. Under gas anesthesia I found a deep introitus, and on passing the index finger into the hymen it ruptured, bleeding considerably. The uterus contained a foetus.



Fig. 2

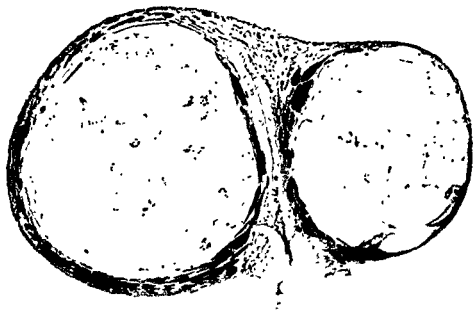
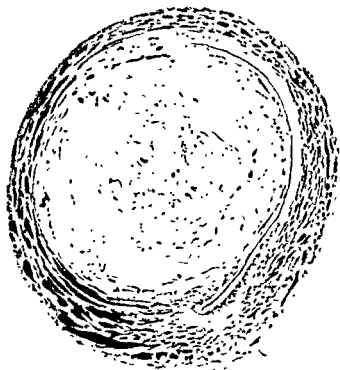


Fig. 27

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## EXPERIENCES IN SPINAL SURGERY<sup>1</sup>

OBSERVATIONS UPON 60 LAMINECTOMIES FOR SPINAL DISEASE

By CHARLES A. ELSBERG, M.D., NEW YORK CITY

THE following observations were made upon 70 consecutive operations for spinal disease. There were 60 primary laminectomies and 10 secondary operations. Laminectomy was performed 22 times for tumor, 9 times for section of posterior roots for pain or spasticity, 4 times for inflammatory bone disease, 5 times for old fracture of the spine, twice for syringo- and hydromyelia, once for intramedullary cyst, once for an arteriovenous aneurysm of the posterior spinal vessels, and 3 times for a peculiar disease of the roots of the cauda equina. In 13 patients not enough was found to explain the symptoms.<sup>2</sup>

In the future, when sufficient time has elapsed, I shall report on the final results in the entire series of patients. As the improvement in most of the patients is of necessity slow and gradual, years must pass before any definite statements of the end results can be made. In this place I desire to lay emphasis on the fact that the mortality of the operation of laminectomy should be a small one. I have recently operated upon the fortieth successive

laminectomy for spinal disease without fatality from the operation. In experienced hands, a laminectomy is neither a particularly hazardous nor a trying operation, and at the Neurological Institute we have come to look upon a laminectomy in a patient in good general condition as a fairly safe operation.

### THE SPECIAL FIELD OF SPINAL SURGERY

Although there are many gaps in our knowledge of the anatomy and physiology of the spinal cord, and of the exact course and relations of the conducting tracts, the recent advances in this field have been many and important. We may confidently expect that much will be added to our knowledge in the near future as a result of clinical and experimental research. In not a few instances, we are already able to diagnosticate the exact level of a spinal lesion and the tracts most affected, and not so rarely we can recognize in what direction the disease process is advancing and therefore say beforehand in what succession other fibres will have their functions compromised.

The surgeon who desires to have the best results in his spinal operations must have a good working knowledge of spinal physiology and pathology, he must be able to determine for himself the level and relations of a spinal lesion, and should be able to recognize, as

<sup>1</sup>The greater number of these operations were performed by the writer at the New York Neurological Institute; some were done at the Mt. Sinai Hospital, the Montefiore Home for Chronic Invalids, and at the patients' homes. Seven patients were operated upon by Dr. E. Heer: section of posterior roots 4 cases, intracerebellar tumor 1 case, removal of cauda tumor 1 case, exploratory 1 case. I desire to thank the gentlemen who referred the patients to me for operation: Drs. Collins, Bailey, Peterson, Frankel, Kennedy, of the Neurological Institute; and Drs. Emma Starr, Sachs, Abrahamson, Straus, and L. S. Saks.

<sup>2</sup>Read at the meeting of the Mississippi Valley Medical Association, Chicago, October 23, 1912.

far as our present knowledge will permit, its nature. Then he will be able to construct in his own mind a picture of the condition of affairs in the spinal canal and thoroughly to understand the manner in which the disease is interfering with the cord's functions. The spinal surgeon will surely be required, more and more often, to invade the tissues of the spinal cord itself, and to attack the cord on its anterior as well as on its posterior aspect. *The operative procedures must be planned to meet the indications in each individual case.*

#### GENERAL FEATURES OF THE TECHNIQUE OF LAMINECTOMY

After some experience, the technique of the operation of laminectomy is seldom difficult. The incision of the skin, the separation of the fascia and muscles from the bones, and the removal of the spinous processes and laminae so as to lay the spinal canal wide open, is a purely mechanical part of the operation and should be accomplished with very little expenditure of time so that the strength of the patient is little taxed before the actual manipulations around the spinal cord are begun. Osteoplastic flap operations are inadvisable and unnecessary, because they are more time consuming and more bloody and do not give as free access to all sides of the cord. The operation of hemilaminectomy is appropriate, I think, for only very few cases, for the same reasons that I have just given. A wide exposure of the spinal canal is usually necessary, both for the purpose of exploration and in order that there shall be as little handling of the cord as possible. The operator should consider that every time that he touches the cord he is doing harm, only then will he have the proper respect for the delicate spinal tissues.

In its technical aspects, spinal surgery has a great advantage over cranial surgery. No matter how skillful and expeditious the operator, the exposure of a part of the brain is of necessity a time-consuming procedure, and the patient's resisting powers are often sorely taxed by the time the dura is exposed. For this reason operations upon the brain are often done in two stages. In spinal surgery,

on the other hand, the mechanical part of the operation can be accomplished very rapidly if the surgeon has some experience and has provided himself with the proper instrumentarium. Two-stage operations are sometimes necessary when the laminectomy is done high up in the cervical region, and when a tumor is to be removed from the interior of the cord by the method of extrusion.

For ordinary purposes, at least two or three spines and laminae have to be removed, but I have often had to remove as many as five to seven before the entire lesion was exposed. The support of the spinal column depends mainly upon the bodies of the vertebrae, and the functions of the spine are well preserved even after seven spinous processes and laminae have been removed.

The dura mater should always be tightly closed after the completion of a spinal operation (excepting in the cases to which reference will be made later) and the muscles, fascia, and skin very carefully closed by interrupted sutures. The careful layer suture of the paravertebral muscles will contribute much to the perfect recovery of the mobility of the spinal column after a laminectomy.

Oozing from the muscles should always be carefully controlled before the dura is incised. The pia-arachnoid can usually be opened separately, so that even if there is a little blood within the dural sac it will not come into direct contact with the cord; and hence those paræsthesias and root pains can be prevented which sometimes follow spinal operations and are due to bleeding into the subarachnoid space.

A laminectomy wound should never be drained, the careful closure of the dura, muscles, fascia, and skin will be the surest preventative of cerebrospinal fluid leakage and the greatest safeguard against meningeal infection. Even when the dura is left open, leakage of cerebrospinal fluid should practically never occur if muscles, fascia, and skin have been well sutured.

When the laminectomy has been done in the cervical region, it is advisable to immobilize the cervical and upper dorsal spine by means of a large posterior splint, but in the dorsal and lumbar regions, no immobiliza-

tion of the spine is necessary. The patients should be kept flat on the back for the first few days, and they usually prefer that position as the most comfortable. When the laminectomy has been done in the lowermost dorsal or lumbar and sacral regions, great care should be taken that the dressings are applied so as to guard against soiling of the wound with urine or feces. This is of course very important, for so many of the patients who require a spinal operation in one of these regions are, from the nature of their disease, more or less incontinent of urine and feces.

#### THE SIGNIFICANCE OF A POSITIVE WASSERMANN REACTION IN PATIENTS WITH SYMPTOMS OF SPINAL TUMOR

The great value and importance of the Wassermann reaction is universally recognized but I am not at all certain that its importance in patients who have a surgical spinal lesion has not been somewhat overestimated. In times gone by, a previous syphilitic infection was excluded by means of a thorough course of mercury and iodides even if no history of a specific infection could be obtained. By means of the serum reaction many patients are saved from an unnecessary and useless course of treatment. But what position shall we take in the case of a patient with the symptoms of a spinal tumor who gives no history of a syphilitic infection, and in whom the Wassermann reaction in the blood or cerebrospinal fluid, or in both is positive? How long is it fair to delay surgical interference? If the symptoms do not recede or continue to progress after an intravenous injection of salvarsan, is further delay justified? I believe that it is almost as great an error to allow a patient with a suspected spinal tumor — even if it be a gumma — to become totally paraplegic while antisyphilitic remedies are being given as to allow a patient with a possibly syphilitic brain tumor to become blind while internal measures are being tried. There is no reason why a patient with a positive Wassermann reaction in the blood and cerebrospinal fluid may not also have a spinal tumor. I have twice removed an extramedullary glioma from the cord of patients whose Wassermann reaction was

positive. Horsley states that it is his belief that a gumma that is of sufficient size to give marked symptoms of brain or spinal tumor should be operated upon. As far as gumma of the spinal cord is concerned, I agree with Horsley's radical view, with the one proviso that an intravenous injection of salvarsan has not caused a marked and rapid improvement. Irreparable injury to the cord may be done by a gummatous growth before it has yielded to anti-syphilitic remedies.

#### ERRORS THAT MAY OCCUR IN THE DIAGNOSIS OF THE LEVEL OF THE LESION — LATE VERSUS EARLY SYMPTOMS

The correct diagnosis of the level of the lesion can be made in most instances if careful and repeated examinations have been made and the disease will be exposed by the operator if he has removed the correct spinous processes and laminae.

I desire to call special attention, however, to what may be called the late symptoms of spinal disease which may be likened to the late symptoms of intracranial disease. As in the case of brain disease, these late symptoms may overshadow the true localizing symptoms. Therefore it is important to obtain a careful history of the early symptoms and the order of their appearance.

If there has been, for a long period of time, a stasis of cerebrospinal fluid above the level of a spinal tumor, motor and sensory symptoms may occur which are due entirely to the pressure of the fluid. In the beginning, these symptoms are irritative, later they are true pressure symptoms. They may give level symptoms far above the real level. The following patient had an extramedullary glioma at the level of the eighth dorsal segment, which was successfully removed, but for many months she had motor and sensory symptoms which pointed to a lesion at the level of the third dorsal segment.

#### EXTRAMEDULLARY GLIOMA OF THE EIGHTH DORSAL SEGMENT; LAMINECTOMY; REMOVAL; RECOVERY

Mrs. H. S., 57 years of age, admitted to the Montefiore Home on the service of Dr. I. Strauss on November 17, 1911. Patient is married and has nine healthy living children; never had any





Fig 1 Appearance of back four weeks after laminectomy.

miscarriage III since sixteen months, beginning with numbness and tingling sensations in the soles of the feet, extending up to hips, painful cramps in legs, increasing loss of sensation first in left then in right lower extremity. Increasing stiffness and loss of power in the lower limbs. After one year, girdle sensation, inability to walk, loss of control of bladder and rectum. For several months before admission tingling in right arm and hand and increasing weakness.

Examination showed complete spastic paraplegia in the lower extremities, with exaggerated reflexes, clonus and Babinski. Complete loss of all sensations up to the level of the eighth dorsal area. Wassermann positive, salvarsan and mercury, slight improvement in the lower limbs, but gradually developing weakness of right and then of left upper extremity, marked loss of all three sensations up to level of D3.

February, 1912. Level of sensory disturbances at third dorsal. Diagnosis at this time, intradural obstruction at level of third dorsal segment. Operation advised at this level, but delayed because of positive Wassermann.

May. Spasticity of the lower limbs much worse; very marked disturbances of sensation in ulnar distribution in both upper extremities.

June 14. Laminectomy at level of the eighth dorsal segment, on account of most marked symptoms at this level (Dr Elsberg). Spines and laminae of seventh, eighth and ninth dorsal vertebrae removed in the usual manner, incision of dura at level of eighth dorsal, to the right and behind cord,



Fig 2 Patient M G Appearance of back four weeks after laminectomy with removal of six spines and laminae.

a small tumor, 2 x 1 cm in size, easily removed. Suture of dura, muscles, fascia, skin, in the usual manner. Duration of the operation, 35 minutes, uncomplicated recovery.

#### REMARKS

This case is of very great interest. For a number of months there was a well marked sensory and motor level at the third dorsal segment. If an operation had been performed during this period (about four months) there would have been every justification for a diagnosis of a lesion at that level and for an opening in the same place — five segments above the true seat of the tumor. The operation was done so low down because it was thought that the high signs were probably due to fluid above the site of the tumor. It is of interest also that the patient had a positive Wassermann reaction, and that the tumor that was removed was a typical glioma.



Fig 3 Helen H X ray six months after laminectomy for tumor of conus and cauda equina



Fig 4 X ray six months after laminectomy for intradural tumor of spinal cord

Secondary degenerations in the cord may, in rare instances, cause a shifting upwards of the level of the sensory and motor symptoms. I have operated upon one patient in whom this error had been made, and the tumor was at first sought too high up.

#### ON THE SUPPOSED DANGER FROM THE SUDDEN ESCAPE OF CEREBROSPINAL FLUID WHEN THE DURA IS OPENED

It is well known that the sudden removal of a large quantity of cerebrospinal fluid by lumbar puncture is often followed by severe general symptoms, such as headache, vomiting, syncope, and sometimes collapse. Most writers speak of the danger of sudden collapse of the patient during an operation, when there

is a sudden escape of a large amount of cerebrospinal fluid. Our experience is entirely against the view that dangerous symptoms result from this escape of fluid. In over 70 spinal operations, I have never seen symptoms which could fairly be ascribed to the escape of the cerebrospinal fluid when the dura was incised. On theoretical grounds, such an occurrence would be surprising. As has been shown by Grashey, Kronig, Propping, and others, the pressure of the spinal fluid in the lumbar region, when the patient is in the horizontal position, is almost zero under normal conditions. When there is pressure on the cord, this pressure may be raised; but it surely can never equal the atmospheric pressure. When the dura is opened, a pres-



Fig. 5 Pierre H. Compression of cord after old fracture. Dislocation of spine in cervical region. The X ray plate shows the marked deformation of the spinal cord.

sure of sixteen pounds to the square inch replaces the intradural pressure. It seems to me that it is much more probable that the symptoms which have often been observed were due to prolonged manipulations which had gone before and to the handling of the cord itself. On no other basis can I explain the entire absence in our series. We are accustomed, however, to lower the end of the table as soon as the fluid begins to escape if it be in large amount.

#### THE OCCURRENCE OF BLADDER DISTURBANCES AFTER LAMINECTOMY—ABDOMINAL DISTENTION AFTER LAMINECTOMY IN THE DORSAL REGION

Even if no disturbances of the bladder existed before the operation, they are very likely to occur afterwards. Usually, there is retention of urine for a few days, rarely, this persists for several weeks. When the laminectomy has been done in the lumbosacral region, the retention is accompanied by a lack of feeling of bladder distention, after an operation in the dorsal or cervical region, the patient will know when his bladder is distended. When the patient regains the con-

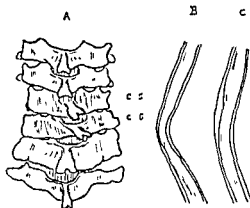


Fig. 6 Pierre H. (a) Outline of cervical vertebrae, showing rotation of fifth and sixth cervical vertebrae. (b) Angulation of cord found at operation. (c) Relief of angulation of cord after removal of spines and laminae of the fourth, fifth and sixth vertebrae. The laminectomy was followed by marked and steady improvement in the patient's symptoms.

trol of his bladder, he is at first, able to empty the bladder only partly, and it often requires several days before the bladder can be entirely emptied.

Unless incontinence existed before the laminectomy it should rarely occur afterwards. If such incontinence does occur it

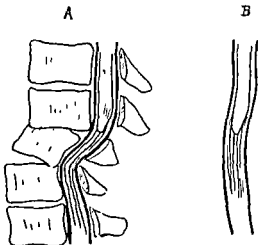


Fig. 7 Laura L. Old fracture of spine, marked improvement after laminectomy. (a) shows the appearance of the spine with pressure on the cord and cauda equina. (b) shows how the conus and cauda were allowed to straighten out after the free removal of spinous processes and laminae. (Diagrammatic.)



Fig 8 Mary G Old fracture of spine with marked deformation

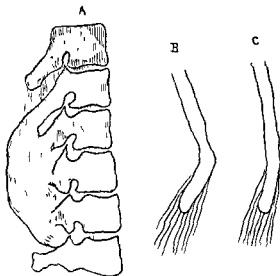


Fig 9 Mary G. Compression of cord from old fracture of spine, marked improvement after laminectomy. (a) shows the marked mass of bone which bound together the spines and caused narrowing of the spinal canal and angulation of the cord (b) shows the angulation of the cord found at operation (c) shows the appearance of the cord after the removal of the bony masses (Diagrammatic)

usually means that some injury has been done to the cord or that there has been considerable bleeding within the sac of the pia-arachnoid. If the incontinence is due to the latter cause, it will usually disappear within a few days or weeks, if due to the former, it may persist for months, and if the injury to the cord has caused a more or less complete transverse lesion, it may be permanent.

Retention of urine calls for regular catheterizations three or four times in twenty-four hours and care should be taken that the bladder never becomes overdistended. Overdistention is very apt to favor cystitis. Uro-tropin is to be given after every spinal operation for several weeks, and its use must be continued longer if the patient has to be catheterized.

After the removal of a tumor or other disease of the cauda equina which has caused retention of urine as one of the symptoms, the retention of urine may persist for a number of months. In these patients, one can often stimulate the bladder to empty itself by

suddenly removing the catheter during catheterization, at the same time that the patient is told to attempt to void his urine with the catheter in place.

*Abdominal distention* may occur after a laminectomy, as after any other operation. But it occurs very frequently after a laminectomy in the lower dorsal region (D<sub>9</sub> to D<sub>12</sub>). After a spinal operation at this level, a very marked and, to the patient, very distressing abdominal distention often occurs, which can be only partly relieved by cathartics or enemata, and which usually persists for several days. The patients are unable to pass any gas, the abdomen is enormously distended, and vomiting sometimes occurs, so that to one who has not seen the condition, the patient seems to present the clinical picture of acute intestinal obstruction. I have seen this condition a number of times, and it has regularly subsided in the course of a few days. The best treatment, in addition to enemata, seems to be small repeated doses of morphin and atropin.



Fig 10 Mrs J S C Old fracture of lamina of the fourth lumbar vertebra

#### THE APPEARANCE OF THE SPINE AND THE FUNCTIONS OF THE SPINAL COLUMN AFTER COMPLETE LAMINECTOMY

From the æsthetic standpoint, the appearance of the back of a patient upon whom a complete laminectomy has been done leaves nothing to be desired (Figs 1 and 2). Excepting for the linear cicatrix, the contour of the back appears almost normal. Sometimes the spinous processes above and below the operative area are somewhat prominent, when this is noticed at the time of the operation, one can rongeur away a small piece of the spines, just above and below the region exposed, before the fascia and skin are closed by suture.

The amount of bone that must usually be removed in the operation of laminectomy is shown in the accompanying X-ray pictures (Figs 3 and 4). The scar tissue that is formed between the divided lamina and the skin is exceedingly dense and hard and forms an excellent protection for the cord beneath. In this scar tissue there are often areas of bone formation, and occasionally an entirely new vertebral arch is formed.

The free mobility of the spinal column is usually fully recovered. For a number of days after the operation, movement of the head, trunk, or extremities will cause pain in

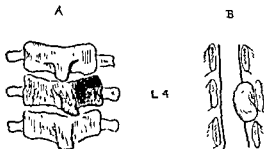


Fig 11 Mrs J S C Appearance of fractured lamina at operation. (b) shows the torn and coiled up ligamentum flavum which compressed the fourth lumbar root. Laminectomy and removal of the torn ligament was followed by complete relief.

the part of the spine that has been operated upon. As soon as this pain disappears the patients are able to turn freely, and within ten to fourteen days they are able to sit up and begin to walk.

For a few months after the laminectomy there is often considerable local stiffness and rigidity of the spine, especially when the patient attempts to bend forward or backward. Lateral mobility is generally well preserved. In some cases, however, the patient is able to move his spine freely in all directions a few weeks after the laminectomy.

Rigidity of the spine is much more apt to be prolonged after laminectomy in the lower dorsal and lumbar regions, and considerable massage and exercises are sometimes necessary before the entire vertebral column regains its normal mobility. In the cervical and upper dorsal regions, the patients very quickly regain the power of free movement of the head in all directions. Some of these patients have a tendency to carry the head somewhat forward, as if there had remained some weakness of the spinal muscles in the cervical region. This muscular weakness soon disappears. Six months or a year after a laminectomy has been done, the vertebral column will be found to be as freely movable as the normal, or as it would have been in the individual case if no operation had been performed.

## THE SURGICAL FEATURES OF OLD FRACTURE OF THE SPINE

The results that have followed operative interference for recent fracture of the spine with signs of serious injury to the cord have been very poor. Either the patients have not been relieved, or the fatal outcome has been hastened, or the patients were improved after the operation. In this latter class of cases it has usually been an open question whether the same improvement would not have occurred if no surgical interference had been attempted. The worst results have followed operative interference for fresh fracture of the cervical spine. In appropriate cases an operation might be performed where the X-ray showed clearly that there was a pressure of bone threatening complete destruction of the spinal cord. Here the surgeon might attempt to relieve a destructive œdema or hemorrhage into the cord, by means of incision of the cord, as suggested by the animal experiments of Allen. In general, however, the surgeon should be very conservative in his recommendation of operative interference. Where the X-ray shows undoubted bone pressure and there is considerable motor power left, an operation may be advised. It has been my experience, however, that it is best to delay surgical interference even in these patients.

There is a class of cases in which the symptoms of the cord lesion are not very marked for weeks or months after the injury, but sooner or later signs of serious and progressing interference with the cord functions appear. In other patients, the signs of a serious cord injury have cleared up to a certain extent, and then improvement has ceased. In both of these classes the X-ray shows that there is, due to the original injury or to new bone formation, marked narrowing of the spinal canal and, therefore pressure on the cord, or a partial dislocation of the body or laminae of one or several vertebrae, causing marked angulation of the cord. These patients can be enormously benefited by a laminectomy, with free removal of spinous processes and laminae and exploratory opening of the dura. By this means a much narrowed spinal canal can be widened and a marked

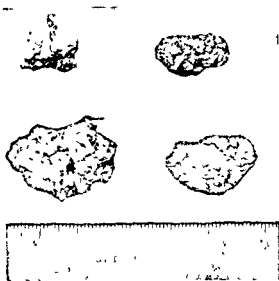


Fig 12 Examples of extramedullary spinal tumors successfully removed at operation

angulation of the cord straightened out by allowing room for the dural sac to bulge backwards. In some of these cases, the prominence on the posterior surface of the body of a vertebra can be removed extradurally. The accompanying X-ray pictures and sketches (Figs 5 to 11) show the conditions that are met with and the changes that are brought about by the decompressive laminectomy. Sometimes it is sufficient to remove the spinous processes and laminae of the affected vertebrae so as to allow the cord in its dural sheath to bulge backward, but in most cases the dura should be incised and the cord examined. A localized cyst or a hamatomyelia cavity may be found and laid open. If necessary, the dural sac should be carefully raised up and a prominence on the posterior aspect of a vertebral body removed. When this is done, there is often considerable venous oozing from the plexuses on the posterior surface of the vertebral body. The bleeding can be controlled by pressure with gauze packings. The results in these patients are very satisfactory. Improvement usually begins soon after the operation, as the following short histories will show:

CASE 1 Compression of cord after old fracture dislocation of spine, laminectomy, steady improve-

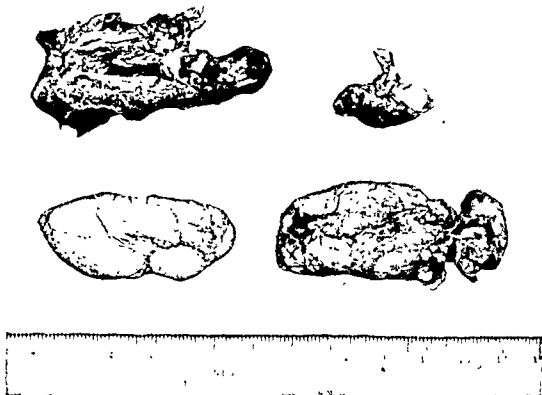


Fig 13 Examples of intramedullary spinal tumors removed from the interior of the cord by the method of extrusion (These tumors appear very large on account of the edema which occurs during the extrusion)

ment (Figs 5 and 6) Pierre H., 27 years of age a private patient of Dr. Peterson at the Neurological Institute. Fell down elevator shaft five months before, unconscious for several days. Paralysis of right arm and leg and weakness of left side. After several weeks some return of power in right leg but increasing weakness of left arm and contractures in right upper extremity.

**Physical examination** — Palpation of spine shows irregularity of fifth and sixth cervical spines. Marked atrophy of muscles of right upper extremity, weakness and spasticity of right and, less so, of left arm, spastic weakness of right lower extremity and slight of left one. Abdominal reflexes absent, knee and ankle jerks exaggerated, right more than left, double ankle clonus and Babinski. Diminution of all sensations up to level of C<sub>4</sub> area more marked on right side. X-ray shows that there is an old fracture and backward displacement of the fifth and sixth cervical vertebrae.

February 8th — Laminectomy (Dr. Elsberg), removal of spines and laminae of fourth, fifth and sixth cervical vertebrae, dura much thickened; incision of dura followed by escape of large amount

of cerebrospinal fluid under pressure, cord much flattened and bent at a marked angle by prominence on posterior surface of body of fifth cervical vertebra. After removal of spines and laminae, cord bulges backward and angulation is straightened out. Suture of dura, muscles, fascia and skin in usual manner. Duration of operation 45 minutes, convalescence uneventful.

February 12th — Abdominal reflexes have returned, slight return of sensation in left foot.

May 1st — There has been constant and progressive improvement in both power and sensation, weakness of left arm and leg have disappeared, marked increase of power in left upper and lower extremity, patient walks about freely, great improvement in sensory disturbances.

**Result** Very marked and steady improvement.

CASE 2. Old fracture of spine with compression of cord, laminectomy (D<sub>10</sub>, 11, 12, L<sub>1</sub>), Great improvement (Fig 7). Laura L., 36, admitted December 26, 1911, to the service of Dr. Collins at the New York Neurological Institute. Fell from wagon 19 months ago and was in bed one week. Pain in back, pain and stiffness in left hip, followed



Fig 14 Large tumors of the cauda equina removed by laminectomy

a few months later by weakness in left and then in right lower extremity. Now complains of cramps in both lower extremities and of weakness in both lower limbs especially the left.

Patient is able to walk only by means of crutches. She has a large supporting splint on the left lower limb. Upper extremities are normal, both lower extremities very weak — the left so weak that the foot can hardly be raised from the bed, double drop foot.

There is hypæsthesia and hypalgesia over the third, fourth and fifth sacral areas on both sides, band of hyperæsthesia and hyperalgesia two inches wide over the right and left distribution of L<sub>2</sub> and L<sub>3</sub>. Stiffness of back in lower dorsal and lumbar regions, tenderness of twelfth dorsal and first lumbar spines. X-ray shows old fracture.

December 28th — Laminectomy (Dr. Elsberg). No irregularity of spine can be felt before operation. Spines and laminae of tenth, eleventh and twelfth dorsal and first lumbar vertebrae removed, spine of twelfth dorsal has been fractured and points obliquely to the left. The dural sac has been pressed backwards by a marked prominence of the body of the first lumbar vertebra. When the dura is opened, the roots of the cauda equina are found

much flattened and tightly stretched at an angle over a prominence of the posterior surface of the body of the first lumbar vertebra. There is a marked deformation of the spinal canal (Fig. 7). The attempt to remove the prominence of the body of the first lumbar had to be desisted from because of the profuse bleeding that ensued when the dural sac was raised and the body of the vertebra exposed. The removal of the spines and laminae had allowed the roots of the cauda equina to bulge backward, so that the marked angulation had disappeared. Suture of dura muscles and skin.

Convalescence from the operation uneventful, gradual improvement in all of the symptoms. By the beginning of January, the patient was able to stand alone without her splint, one month later she was walking around freely with the aid of one cane. The band of hyperæsthesia had disappeared, and the perineal sensory loss was much less marked. Two months later, the patient was walking around without any support, she walked up and down stairs without trouble and was able to attend to her housework. The drop foot on the right side had disappeared, there was only slight weakness of the left side, power in the right lower extremity was normal, of left, was much improved. Can raise



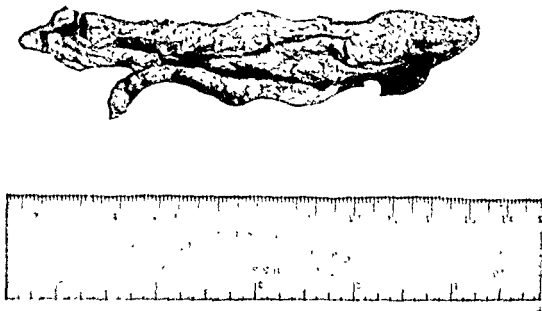


Fig. 15. Very large tumor of the conus and cauda equina, removed successfully at operation.

both feet from bed with ease. Knee and ankle jerks still absent. The patient returned to her home in the South and has not been heard from since.

**CASE 3. Compression from cord of old fracture 18 years before laminectomy, very marked improvement.** Mary G., 36 years of age, service of Dr. Bailey at the Neurological Institute (Figs. 8 and 9) (Reported by Dr. Bailey at the meeting of the American Neurological Association 1911).

At the age of 18 fell from back of mule, striking on her back. Except for some stiffness of the back, she was not apparently hurt and did not go to bed. Three days later a prominence was noticed in the middle of her back, but, excepting for the fact that her back was somewhat stiff, she had no symptoms. Three months before admission she began to have very severe aching pains in both of her legs, and had to go to bed on account of the pain.

**Physical examination.**—Marked weakness of both legs—cannot raise the left from the bed, the right only about six inches. All the muscles of both legs are atrophic, the left more than the right, knee jerks absent, jerks present double clonus and Babinski. There is a marked deformity of the lumbar spine, a very prominent gibbus from twelfth dorsal to the fourth lumbar, most marked at the

second lumbar spine. There is a complete loss of all three sensations over the third, fourth and fifth lumbar and first sacral areas on both sides, and a marked diminution of all sensations over the second and third sacral area. X ray shows a destruction of the lower surface of the body of the first lumbar and upper surface of the body of the second lumbar vertebra and some destruction of the bodies of the second and third lumbar vertebrae, and a large amount of new formed bone around the arches of the twelfth dorsal to fourth lumbar arches.

January 28, 1911—Laminectomy (Dr. Elsberg). Spinous processes of third and fourth lumbar, and then successively of the second, first lumbar and twelfth dorsal vertebrae removed. The removal was very difficult on account of the large amount of new formed bone which bound together the arches of the vertebrae (Fig. 6). The cord with its envelopes was much compressed and bent at an angle; it seemed almost to be spitted on a prominence of the body of the second lumbar vertebra. The cord and cauda equina were bent at an angle (see diagram) and it was clear that they were compressed against the sharp shelf formed by the body of the second lumbar vertebra. At this point, the inner surface of the dura was markedly congested and

had a shaggy appearance. Most of the new-formed bone was removed. Suture of the dura, muscles, fascia, and skin in the usual manner.

Convalescence uneventful; marked and rapid improvement.

March 7th.—Can raise both limbs freely from bed; can stand unsupported and can walk with some assistance; pain in thighs much less; almost all of the sensory disturbances have disappeared, and it is difficult to find any area in which there is any definite diminution in sensibility.

April 21st.—Discharged, relieved; all sensory disturbances have disappeared; back is still rigid; patient says that pain in thighs is much less. She now has good power in both limbs, and walks around without assistance; ankle clonus and Babinski have disappeared; knee jerks present on both sides. Still has some pain around the left hip.

CASE 4. *Compression of fourth lumbar root by torn ligamentum subflavum and fractured lamina of fourth lumbar vertebra. Laminectomy, removal of ligament; complete relief* (Figs. 10 and 11). Mrs. J. S. C., a patient of Dr. M. Allen Starr, 49 years of age. Thrown out of an automobile ten months ago, stiffness of back since that time. Six weeks ago, pain over the distribution of the fourth lumbar root on the left side, rapidly growing very severe. X-ray shows old fracture and thickening of arches of fourth and fifth lumbar vertebrae.

Laminectomy June 25, 1912 (Dr. Elsberg). Removal of spines and laminae of third, fourth, and fifth lumbar vertebrae. Lamina of fourth is dorsally dislocated on the left side, the arch of the fourth vertebra having evidently been fractured and carried to the left. As soon as the left lamina of the fourth lumbar vertebra was removed, a firm mass bulged out of the spinal canal. The mass was about 2 cm. thick, and the manner in which it was forced out showed that it must have been under considerable pressure in the canal. The mass was excised and proved to be a much thickened ligamentum subflavum, which had evidently been torn loose at the time of the accident, ten months before. Part of the fourth lumbar root on the left side was then divided. Suture of muscles, fascia, and skin in usual manner. Duration of operation 30 minutes.

Convalescence uneventful. Patient out of bed in two weeks, relieved of all of her pain. Complete recovery.

#### REMARKS

These four cases are given in some detail in order to show how very satisfactory are the results that can be obtained in these patients. The relief of the pain is often immediate, and improvement in sensory and motor symptoms very rapid. Fracture of a spinous process or lamina occurs much more often than we believe, and all the symptoms that the patient may have at the time of the injury may be a

little pain and stiffness in the back. Only later, when the pressure on the cord gives rise to symptoms, does the real nature of the injury become clear. I believe that if all of the patients who are treated for a sprain or wrench of the back were subjected to an X-ray examination, an injury to the bony framework of the spine would be often discovered. It is remarkable, also, how often a serious injury to one or more vertebral bodies will give few symptoms.

I have operated upon several patients from whom no history of an injury to the back could be obtained, but in whom the X-ray findings and the operation demonstrated that there must have been, at some time or other, an injury to the spinal column. While in some of these patients the improvement occurs very quickly, in others it is very slow, and months or years will pass before most of the symptoms have disappeared. If the knee and ankle jerks are absent, it may take many months before they again appear. When there has been much new bone formation, the laminae of the affected vertebrae should always be removed very freely, so that the intervertebral foramina are exposed. If this is not done, disagreeable root pains may persist. Often it is advisable to cut the most affected posterior root. The operator must always be certain that he has removed a sufficient number of vertebral arches so that the cord and its membranes can bulge backwards and any angulation be entirely relieved.

#### THE SURGICAL ASPECTS OF SPINAL DECOMPRESSION

In the paper by Dr. Bailey and the writer,<sup>1</sup> we have called attention to the remarkable effects that sometimes follow a laminectomy for symptoms of local spinal disease where nothing abnormal is found inside or outside of the dura, and where there is no increase of pressure. In that paper we suggested that the benefits that seem to accrue might be due to changes in the spinal circulation or might result from the entrance of air into the spinal canal. Since that paper was published, I have operated upon several additional

<sup>1</sup> Pearce Bailey and C. A. Elsberg, Spinal Decompression, J. Am. M. Ass., March 9, 1912, vol. 38.

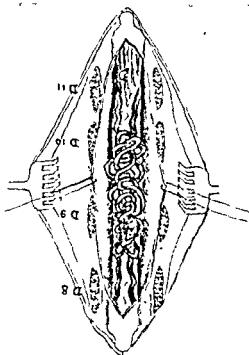


Fig 16. Arteriovenous aneurysm of the posterior spinal vessels, giving the symptoms of a spinal tumor

patients and have seen great relief from the symptoms, so that our conclusion is justified, that the opening of the spinal canal may, and often does, have a profound effect upon the spinal cord. This may act beneficially upon some spinal diseases whose nature is as yet not understood and whose pathology is unknown. I have recently operated upon a patient with a spinal disease, who had been incontinent for a number of months. Nothing was found at the operation to explain her symptoms, but she recovered control of her bladder within a short time of the operation.

There is a peculiar disease of the roots of the cauda equina which has not, as far as I have been able to determine, been described. The symptoms which the patients present are very like those of tumor of the cauda equina. Although nothing is found at the operation that can be relieved by surgical means, all of the patients improved very much after the operation, and the result can only be ascribed to the laminectomy. These cases will soon

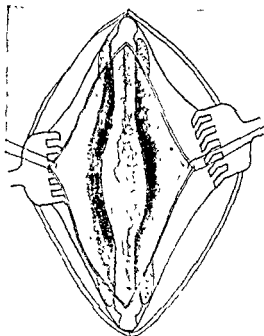


Fig 17. The appearance of the cord in the case of Dr. L., with an intramedullary tumor of the cervical cord.

be described in detail by Dr. Kennedy and the writer

#### INTRAMEDULLARY AND EXTRAMEDULLARY SPINAL TUMORS AND THEIR REMOVAL

In my series of twenty-two cases of spinal tumor, four were extradural and eighteen intradural. Of the latter, eight were cervical, five dorsal, two lumbar, and seven affected the conus and roots of the cauda equina. Of the intradural tumors, five were intramedullary and thirteen extramedullary (Figs. 12 to 21).

The removal of an extramedullary tumor of the spinal cord is one of the most satisfactory of all operations. If the tumor has been correctly localized and the proper spines and laminae have been removed, the operation can usually be done in half an hour, or less, and the dangers of the operation are very small. It is always advisable to remove at least two or three spines and laminae, so that the tumor is well exposed. The operation can usually be done in one stage, excepting when the growth is in the upper or middle cervical

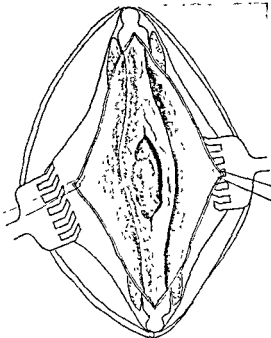


Fig 18 Beginning extrusion of the tumor in the case of Dr L., after incision of the posterior column of the cord over the prominence of the growth.

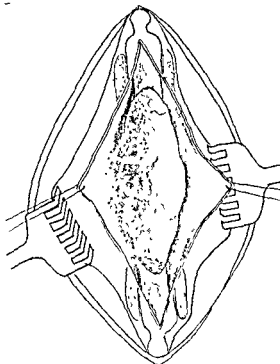


Fig 19 The completely extruded tumor in the case of Dr L. The tumor was removed with ease, and the patient has recovered to a very marked extent (Large size growth due to oedema, which occurs during extrusion.)

region. In these latter cases, it is often preferable to stop as soon as the tumor has been exposed, so as to allow a readjustment of pressure conditions on account of the proximity of the medulla.

The removal of giant tumors surrounding the roots of the cauda equina (Figs 14 and 15) can also be made more easy and safe if the actual removal of the tumor is delayed for a few days or a week. These tumors surround the roots of the cauda, and it is often difficult to free the roots without the infliction of considerable injury to one or the other of the roots. If the dura is left open until the second stage, the tumor will be found to be partly extruded from the spinal canal and from the roots of the cauda.

Intramedullary tumors must always be removed in two stages, by the extrusion method, as described by Dr Beer and myself.<sup>1</sup> I have elsewhere written in detail regarding the principles of intramedullary surgery — procedures which I hope will much extend the field of spinal surgery. Based upon anatomical and histological considera-

tions, I have shown that it is both feasible and safe to incise the cord in order to allow of the extrusion of localized intramedullary growths to empty cysts of the cord, and for intramedullary decompression in irremovable tumors, syringomyelia, etc. By the method of extrusion (Figs 17 to 19), the separation of a tumor from its bed or cavity in the cord is left to the processes of nature. These processes are based upon pressure conditions in the cord. Nature can accomplish the end desired with far less danger of injury to the delicate structures of the cord than the most gentle manipulations of the operator. Therefore, the surgeon must leave to nature the actual extrusion of the growth, by the free removal of spinous processes and laminae and by a properly placed incision in the cord substance, he must make conditions as favorable for the extrusion of the tumor as possible. Finally, when the tumor has been extruded

<sup>1</sup> Elsberg and Beer *Am J M Sciences* November, 1911.

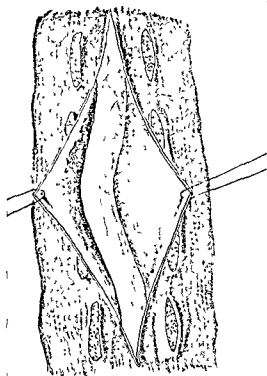


Fig 20 An extradural tumor of the spine. Louis H. The dura is open and retracted, showing dislocation of the cord by the growth which is causing a bulging of the dura.

from its bed in the cord, he must remove the tumor without injury to the delicate structures which surround it.

When the tumor lies outside of the cord, either under the pia-arachnoid or under the dura, its removal is usually accomplished with ease. Many of the growths lie on the posterolateral aspect of the cord, so that when the dura is incised and retracted the tumor is raised from the cord. If it lies under the pia-arachnoid, these membranes will have to be divided before the tumor can be extracted. If the tumor lies on the anterolateral aspect of the cord, one can usually expose it very satisfactorily by dividing one slip of the ligamentum denticulatum. The ligament is then grasped with *fine forceps* and drawn backward until the growth has been removed. If a tumor on the anterior surface of the cord is of small size, the division of one slip of the

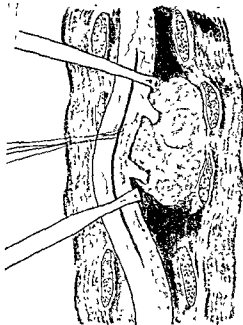


Fig 21 Louis H. Dural sac retracted to show the tumor in its bed in the spinal canal. In this patient, the X-ray picture showed a marked enlargement of the canal at the level of the tumor, due to absorption of the bone.

dentate ligament will allow the cord to be drawn out of the way and rotated sufficiently to permit of the removal of the growth. Sometimes, however, it is necessary to divide one posterior root before the tumor can be well exposed.

It is not advisable to make a careful examination of the cord after the tumor has been extracted, because these flattened cords are very soft and easily injured.

If a posterior root is found stretched over the tumor, especially if there have been severe root pains referred to that nerve before the operation, the root in question should be divided. Disagreeable root pains sometimes persist in a posterior root which has been long pressed upon by a tumor.

The dura must always be opened, even if an extradural tumor has been found, for there is sometimes an intradural growth as well. Palpation through the dura is an uncertain procedure, and a small intradural tumor on the anterior or anterolateral surface of the cord might easily be missed.

SUBCUTANEOUS RUPTURE OF THE DIAPHRAGM AND POSITIVE PRESSURE (MELTZER)<sup>1</sup>

## AN EXPERIMENTAL AND CLINICAL STUDY

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ON September 8, 1910, the following case came under my observation: A boy about ten years of age was brought to People's Hospital with this history: A wagon loaded with gasoline cans passed over his left leg and side of chest, almost cutting off his ear, while the boy was lying prone on the ground. I saw him about two hours after the accident. His facial expression was anxious; pulse 116, rapid, thready, and irregular. He was sitting up in bed, unable to lie down. Had vomited shortly after entering and vomited again after my arrival. Muscular defense had been noted upon his arrival and was not well marked. The abdomen was distended in the epigastric region, the lower portion of the chest wall seemed broader than normal. There was considerable tympany over the epigastrium; percussion over the chest elicited tympany as far as the level of the fourth rib. No breath sounds were heard over the left chest. The heart tones were very indistinct and the apex beat could not be located. The breathing was jerky, as if due to fixation of the diaphragm, the same as during a severe gall-stone attack. He complained of pain "about the heart." The epigastrium was tender. The liver dullness was almost obliterated. Urine had been voided and was normal. There was no dullness in the flanks. The skin over the epigastrium felt somewhat emphysematous. The symptoms pointed strongly to a rupture of the diaphragm and that of a hollow viscus. The boy was etherized and an incision made in the median line from ensiform to navel. The breathing became more regular after complete anesthesia had begun. When the peritoneum was reached, this bulged out as if under pressure. Upon incision there was a hissing sound, some loops of distended small intestines slipped out of the wound. There was no blood or gastro-intestinal contents in the abdominal cavity. The transverse colon was in the place commonly occupied by the stomach. With difficulty I located the pylorus and, following this, found almost the entire stomach in the pleural cavity. The entire left half of the diaphragm, as far back as the costal angle, had been detached from the ribs at right angles to its fibres. The opening admitted four fingers widely spread. Upon withdrawing the stomach from the chest cavity the boy's respiration became much embarrassed and very shallow. Direct heart massage was practiced through the tear. The left ventricle contracted vigorously for some time, but respiration ceased and could not be

re-established. Inspection revealed the stomach and intestines as well as parenchymatous organs uninjured. A post-mortem was not held.

A search of the literature shows that the number of reported cases is not great, while one rarely finds a case which recovered. The scarcity of published cases does not indicate that the occurrence of this condition is so rare, for a personal communication with a number of surgeons engaged in accident and emergency work revealed the fact that each one had one or more of these cases. I wish to draw attention to the sharp difference between open and closed diaphragmatic wounds. The former are rarely associated with immediate prolapse of abdominal organs, excepting the omentum, because as a rule the opening is too small, operative interference is usually successful, while in the subcutaneous tears of the diaphragm, which are usually large, a prolapse is the rule, and the outcome, with or without operation, as mentioned above. Whatever the individual surgeon's opinion may be regarding the use of differential pressure in operative pneumothorax, whether necessary or not, I have the conviction that if it could have been employed in this case it might have gone to a happier termination. A number of experiments were undertaken, to study both the physiological side of subcutaneous rupture of the diaphragm, and to suture a diaphragmatic wound under differential pressure to ascertain its advantages, if any. The admirable simplicity of Meltzer's insufflation apparatus commended its use, hoping that in its original form it might be used in the human in a case of emergency without much trouble and expense.

The air supply was furnished by an electric pump, the air passing through a Wulff bottle one half full of ether. A manometer was placed in the circuit. A soft rubber catheter, size 21, French,

<sup>1</sup>Read before the Chicago Surgical Society, November, 1911. (See discussion, p. 225.)

served as tracheal catheter. The tip of the catheter was cut off and the edges trimmed. At times I used a second Wolff bottled filled with cold water to moisten and cool the air before passing through the ether. A general test showed that the apparatus worked well as far as maintenance of differential pressure was concerned. The middle lobe of the right lung was resected in one dog with good success, in another the sternum was removed in toto, exposing both pleural cavities. The dog was kept alive and breathing regularly under a pressure from 10 to 20 mm for two hours. The experiment was discontinued for external reasons and could have been kept up much longer.

The advantages of this method for anaesthesia I merely emphasize in passing, as it has been used by Elsberg and others in many cases on the human subject, irrespective of its pressure features.

Nine dogs were used for the experiments, two of these for the study of the results of rupture of the diaphragm only, the remainder for suture of the lesions produced. The incisions in the diaphragm were made uniformly on the left side in the muscular portion of the diaphragm at right angles to the course of the fibres and large enough to admit three fingers. In one dog (No. 7) an abdominal opening was made and the diaphragm incised. Insufflation which had been employed up to that time, was discontinued after the hemorrhage had been stopped. There was a prolapse of abdominal viscera. At most immediately respiration ceased, blood pressure (Riva Rocci) fell to zero and insufflation had to be recommenced. This proved successful, blood pressure rose to 70 mm, the dog however died after a few minutes. Both lungs were pink and showed no signs of edema. The right ventricle was distended. In another dog (No. 8) the chest was opened by a quadrilateral flap without insufflation, respiration became quite shallow and finally ceased. The heart continued to beat for a while then stopped. At this time insufflation was instituted and the dog revived. The diaphragm was incised, the stomach allowed to prolapse into the pleural cavity, and the flap closed by two layers of sutures. Blood pressure ranged from 75 mm to zero before insufflation, afterwards at the close of the operation, from 98 to 90 mm. The dog recovered from the anaesthetic completely, but died somewhat suddenly one hour later. In the other seven dogs used for suture experiments, insufflation was used throughout. After incision of the diaphragm the proximal portion of the muscle was pushed over to the right side and the blood pressure taken before, during, and after the experiment. No appreciable changes were noted in the blood pressure. The insufflation pressure ranged from 10 to 25 mm during the suture of the diaphragm and was increased to 35 mm while closing the wound to drive out all the air. Respiratory movements were almost absent,

and this state of comparative apnoea greatly facilitated the suturing, as the diaphragm hardly moved. It was possible to introduce a continued suture, closing the rent in the diaphragm completely. In those dogs where the tear was produced through the abdomen I placed it dorsally, and found the mobilization of the diaphragm, by resection of the ninth rib at the junction with its cartilage and resection of the tenth rib in the axillary line (Lannelongue-Willy Meyer), quite advantageous to bring the diaphragm into a position of inspiration and thus render the somewhat inaccessible tear more superficial. Here again the absence of diaphragmatic movements proved to be of great assistance in thorough and rapid suture. I repeated this mobilization of the diaphragm in a couple of cadavers and found it satisfactory. The transpleural route offered, of course, less difficulties in suturing. It was employed in three of the dogs. The chest was opened by a rectangular flap containing bone, muscle, and skin and comprising two ribs. It was closed in two layers. In the remaining four dogs the abdominal route was chosen. None of the dogs died from the immediate effects of the operation. Insufflation without ether was usually continued from 5 to 10 minutes after the conclusion of the operation and seemed to have a highly stimulating effect upon the animal materially hastening its recovery from the anaesthetic, also obviating nausea and vomiting. Morphia was employed in the earlier experiments, but later discarded to avoid any influence upon the respiration and blood pressure. The experiments were carried on during very hot weather, aseptis was also but partial. This interfered much with ultimate results. The blood pressure usually rose when the diaphragm was incised through the abdomen.

Before attempting to draw any conclusions from these experiments it must be admitted that they were rather incomplete and limited in number. Again the element of severe traumatic shock so constantly present in this class of injuries, as well as the frequent trauma of other organs, was absent. The anatomical and functional differences between the diaphragm of man and that of the lower animals does not permit of direct application of observations in the dog, inasmuch as the pericardium and diaphragm are not united and the heart does not depend upon the diaphragm as much in this animal as it does in man. Functionally it has not the importance for the circulation which it possesses in man, because, owing to the horizontal posture of the animal, a relatively small force is required to maintain the general circulation and promote the re-

turn of the blood from the abdomen. These advantages are offset by the frequent communication between the two pleural cavities in the dog. The normal as well as the pathological physiology of the diaphragm still offers many problems. I am indebted to the splendid work of Hans Eppinger for much information upon this subject, and shall quote it freely:

The following anatomical considerations are of importance. In man the central tendon supports the heart, while the fibrous pericardium may be regarded as the fascial insertion of the muscular diaphragm. Through this fibrous pericardium and its continuation upward into the sheath of the great vessels, which in turn is continuous with the middle layer of the deep fascia of the neck and the carotid sheath, the diaphragm is closely connected with the great vessels. From beneath, the diaphragm is supported by the abdominal viscera, themselves kept in place by the tonic contraction of the abdominal muscles. More specifically, the inferior supports are the liver and its falciform, coronary, and lateral ligaments. Further supports are the inferior vena cava, through its attachment to the liver, and the stomach and intestines, which constitute an air cushion on which the solid viscera, especially the liver, are supported. The diaphragm serves both as tractor as well as a compressor. It assumes its rôle of respiratory function only after birth, serving as a circulatory muscle during intrauterine existence.

The diaphragm plays the most important rôle in maintaining equilibrium within the thoracic cavity. The tonus and the active force of the midriff antagonize the elastic force of the lung and the cohesion of the pleural layers. Both forces keep up the balance between elasticity of the lung, negative intrathoracic pressure, the tension of the diaphragmatic fibres and the other muscles surrounding the thorax. During moderate contraction of the diaphragm the enlargement of the thoracic cavity is caused chiefly by rendering the complementary space larger, while with deeper inspiration the centrum tendineum is considerably depressed. Ex-

cessive contraction of all the muscular fibres of the diaphragm may produce a horizontal position of this structure. Occasionally these contractions may become so strong that there is contraction at the very point of origin, with narrowing of the lower thoracic aperture. Normally several factors prevent this—amongst these, mainly, the costal inspiratory muscles and the increase in intra-abdominal pressure. These may not only regulate but overcorrect the contraction and produce a widening of the lower thoracic aperture.

The importance of intra-abdominal pressure in this direction has been proven by Duchenne's experiments. Phrenic nerve stimulation causes spreading of the lower ribs with closed abdomen, which is changed to retraction as soon as the abdomen is opened. The position of the diaphragm changes with posture, and this mainly depends upon resultant changes in intra abdominal pressure. The influence of the diaphragm upon the circulation has been alluded to before. From important observations the conclusion may be drawn that the diaphragm is one of the most important supporters of cardiac function as well as of the circulation. This function can be observed throughout the animal series, from the lowest to the highest. Keith points out the useful arrangement of the muscular bundles in relation to the heart and the inferior vena cava, whereby the right auricle is brought nearer to the blood reservoir with each contraction, facilitating its more rapid repletion. The diaphragm is likewise a most important factor in the hepatic return circulation. It has been proven experimentally that the volume of the heart beat increases with each contraction of the diaphragm. The main function of the diaphragm may thus be summarized to be the following:

- (a) Barrier between thoracic and abdominal cavities.
- (b) Ventilation of the lung.
- (c) Regulation of abdominal circulation.

In view of this fact one might expect an injury to the diaphragm to be followed by interference with the ventilation of the lung and disturbances in circulation. As the greater portion of respiration is internal, depending upon an exchange of gases between



DATE	NO.	ROUTE	POSITIVE PRESSURE	ANÆSTHETIC	RESULT
6-23-11	1	Chest	Insufflation	Morphin, ether	Death after 1 week Infection
6-30-11	2	Abdomen Transverse incision Resection of eighth, ninth, and tenth ribs	Insufflation 25 mm and 30 mm	Ether, morphin	Death after 4 days Infection
8-8-11	3	Abdomen Resection of car- tilage of eighth and ninth ribs	Insufflation 10 mm and 35 mm 25 mm	Morphin, ether	Alive and well
8-8-11	4	Chest Flap consisting of sixth, seventh, and eighth ribs	25 mm	Ether	Alive and well
8-11-11	5	Chest	25 mm	Ether	Death 4 days later
8-11-11	6	Abdomen Resection of ninth rib at junction with its car- tilage Resection of tenth in axillary line	25 mm	Ether	Alive and well
8-18-11	8	Chest	25 mm	Ether	Tore wound open with teeth Infection Death after 3 days
8-21-11	10	Abdomen	25 mm	Ether	Death 3 days later from infection

blood stream and tissues, the ultimate result would be insufficient aeration of the entire system. Under ordinary circumstances this is counterbalanced by other forces which maintain equilibrium. In our experiments positive pressure permitted dislocation of the thoracic viscera, after incising the diaphragm to quite a degree, without evil consequences. In open wounds of the diaphragm without prolapse, the existing pneumothorax equalizes, perhaps, the deleterious effects of positive intra-abdominal pressure. In subcutaneous rupture conditions are different. The action of the diaphragm, though impaired, will aspirate the viscera into the pleural cavity, creating there a condition of varying, though more or less positive, pressure as we find it in the abdomen.

Why do these patients react so violently to the creation of an operative pneumothorax? One would rather expect that the entrance of air would equalize the pressure. A common pneumothorax is no longer feared by surgeons. Differential pressure would not be required to offset the entrance of air, but rather to maintain equilibrium during handling of thoracic organs, causing more or less

violent disturbances in equilibrium. The entrance of air into the chest cavity is followed by a collapse of the lung. This may be partial or complete according to the size of the aperture. It is complete if the aperture is greater than the diameter of the largest bronchus. In a normal chest cavity pneumothorax may not be associated with any symptoms whatsoever, as the following case well illustrates.

A colored girl received a razor cut, severing the third, fourth and fifth left costal cartilages at a little distance from the sternum. The internal mammary artery was not injured. The wound was pulled apart by retractors, one could see a completely collapsed lung in the upper portion of the thorax. Neither heart nor lung were injured. The wound was closed, no special symptoms were observed during examination. Dyspnea was very slight. A complete recovery followed.

This truly was a complete collapse of the lung, but not a pneumothorax, if we are to express by that term the alarming train of symptoms, other factors must evidently enter. These have been attributed to insufficient fixation of the mediastinal pleura, which flutters to and fro in respiration (Murphy and Garré), kinking of the larger

bronchi by displacement of the mediastina (Rehn), circulatory disturbances due to kinking of the great vessels (Friedrich), and a deficiency of the lung ventilation (Tiegel); prolapse of stomach or intestines produces conditions which closely resemble those enumerated in closed or tension pneumothorax, so that one could speak of an internal pneumothorax if this term was not misleading. The entry of air from without must necessarily aggravate the symptoms, and if toleration is exceeded, that is, the thoracic equilibrium disturbed, with fatal results due to insufficient internal respiration.

There are undoubtedly other factors besides mechanical ones, and they may not unlikely be found in an increased sensitiveness of the visceral pleura, as experienced by Lewis and Capps. These observers found that touching a diseased visceral pleura with a needle during aspiration may lead to instantaneous death. Their observations showed the cause to be found in the sympathetic nervous system. How much the element of shock, always present in subcutaneous injuries of the diaphragm, adds to increased vulnerability of the sympathetic system is not easy to determine.

Diaphragmatic herniæ have frequently been operated upon with success long before the advent of pressure apparatus. These successes must be attributed to conformation of the chest contents to the alteration, for as a rule these cases are of more or less long standing, and here a pneumothorax would not produce the fatal disturbances as in the acute cases under consideration. It has been argued that the transpleural approach in diaphragmatic rupture will give better results; that the operative pneumothorax will counterbalance position pressure in the thoracic cavity. The few cases, however, which recovered after operation have been laparotomized. The variations in the character of the mediastina must be taken into consideration. In the child they are much thinner than in the adult, and the thickness varies greatly in different individuals.

As stated before, subcutaneous ruptures are not as rare as one would believe. It is surprising to find, in Lachner's compilation of 266

cases of diaphragmatic hernia, the following relations:

Open	{ 37 due to stab wound . . . . }	Total
	{ 14 due to gunshot wound . . . }	31
Subcu- taneous	{ 35 due to falls from a great height 7 due to burying accidents 3 due to compression of the thorax }	Total 45

This furnishes positive proof that the condition is more frequent than would appear at first glance and should be looked for in examination of persons suspected of having sustained a subcutaneous trauma of the chest or abdomen, during operation as well as before. It is not necessary to dwell here again on the disastrous consequences of this injury, either immediate or remote, as they are well known. In surgical text-books this form of subcutaneous injury receives but scant mention. The cases of Suter and Walker are about the only ones where operation was undertaken for the previously diagnosed condition. The mechanism of diaphragmatic rupture is not uniform. The commonest is a rise of intra-abdominal pressure, transmitted through a medium of gas and fluid, which pushes the diaphragm upward and stretches it beyond the point of endurance. The rupture may be the result of a forcible straightening of the ribs and pushing up of the thorax, such as occurs in a more lateral compression of the lower chest and abdomen. An intermediate between rupture and stab wounds is represented by perforations of the diaphragm by a fractured rib. This is uncommon. The increase in intra-abdominal pressure causes at the same time forced expiration, and with it a minimum of intrathoracic pressure. The diaphragm is deprived of its brace above, and ruptures.

The most common causes of increased intra-abdominal pressure are run-overs, burying accidents or falls from a height. It is an interesting fact that this increased tension may work in two directions, either upon the diaphragm or upon the pelvic floor; if very excessive it may attack both (Kirschner's case). The diaphragm generally ruptures at its outer margin, in the muscular portion. Obviously the rupture occurs more often on the left side (5 to 1), because the compact and non-yielding liver receives and breaks the

force on the right side, thus protecting the diaphragm. Rupture as the result of muscular contraction of the diaphragm is exceedingly rare. König asserts that this will hardly occur without previous degenerative changes. The tear in this variety affects the centrum tendineum. Sutor cites three cases from the literature, reported by Desiret de Fortunet (Lyon méd., 1886). One was that of a woman who sustained a rupture of the midriff during labor; the second, of a man during a violent attack of vomiting, produced by an emetic, while the third suffered the same injury during an attempt to hold up a heavy barrel. These injuries took place during forced inspiration, while the traumatic variety takes place during forced expiration. Malgaigne is of the opinion that ruptures of the muscular portion occur during expiration, those of the central tendinous part during inspiration. The symptoms of diaphragmatic rupture depend largely, if not altogether, upon the prolapse of abdominal organs. A small tear without prolapse will not present any diagnostic signs. The so called classical symptoms and signs might conveniently be grouped under three classes:

(a) *Those due to insufficient air supply*

Excessive dyspnoea orthopnoea

Rapid, irregular weak pulse

Anxious facial expression amounting at times to a risus sardonius, as mentioned by Percy, a French physician

(b) *Those connected with the displaced organs*

Vomiting, due to traction on the mesenteric attachments of the displaced viscera or by actual interruption of the blood supply

Muscular defense as a consequence of a lesion of the peritoneum

Physical signs

Tympany over the chest, amphoric breathing, succussion or gurgling sounds over the chest.

Widening of the chest

Distention of the epigastrium

(c) *Symptoms referable to injury of the diaphragm*

Jerky respiration.

Pain on forced inspiration or coughing.

(d) *Referred symptoms.*

Pain in the shoulder, due to irritation of branches of the phrenic nerve.

General symptoms of a severe trauma, such as shock, are rarely absent; associated visceral lesions may overshadow the symptoms of diaphragmatic rupture to a large degree. It is hardly necessary to state that, with the exception of actual physical findings, of prolapse, the remainder of the symptoms are merely suggestive.

SUMMARY

1 The diaphragm in man has an important influence upon the heart's action, by its anatomical relation to the heart and pericardium

2 It is an important factor in the circulation by aiding venous return, especially from the abdominal cavity

3 It plays an important part in maintaining equilibrium in the thoracic cavity.

4 Rupture of the diaphragm must needs be followed by serious disturbances in internal respiration and in the equilibrium within the thoracic cavity

5 The inevitable prolapse of abdominal organs following subcutaneous rupture still increases this condition, frequently producing a state of positive pressure in the thoracic cavity

6 The use of differential pressure is absolutely necessary to overcome these factors.

7 It will insure better results, in these cases, permitting furthermore the choice of abdominal or transpleural route or both as the occasion requires

8 The character of pressure, whether positive or negative, is of little consequence, but the method of Meltzer is simple and can be used anywhere.

9 In cases of suspected subcutaneous rupture of the diaphragm, insufflation should be employed with low pressure (10 to 15 mm.) before operation, to overcome the deleterious effects of disturbed intrathoracic equilibrium.

CASE 1 Woman, 40 years old; fell from wagon, then run over. Several ribs broken on each side of the chest. Drunk. No sign of shock. No

vomiting No dyspnoea. Death on following morning Post-mortem: Fracture of third to eighth ribs on right side; fourth to eleventh ribs on left side Left pleural sac contained stomach, spleen, transverse colon, and several feet of small intestine Left lung was collapsed. The left dome of the diaphragm was completely torn across Lesion not suspected ante-mortem

CASE 2. Woman, 61 years of age Wheel of van passed over the lower part of the chest. Discharged from hospital, at end of seven days, apparently well. Attended to house duties, but never seemed well since the accident, occasional attacks of breathlessness Ninety-one days after accident, was out during the whole morning, but, on returning home, said she did not feel well and went to bed. At 6 P M she was given a large quantity of soda water, and immediately afterwards she vomited and became unconscious She did not rally, and died three hours later

Post-mortem The left pleural sac was almost filled by the enormously dilated stomach The lung was very small and was flattened against the left side of the spine, while the heart was so far dislodged as to be entirely to the right of the middle line The left side contained, also, the spleen and three feet of small intestine The left dome of the diaphragm was completely torn across from front to back, while the viscera entering and leaving the chest were tightly strangled by the sharp cicatrized edges of the rent There was no injury to the chest wall or to any other part of the body Death would appear to have resulted from acute distention of the stomach by gas derived from the effervescent draught

CASE 3. Henry M., age 50, fell July 2, 1906, twenty feet, striking on occiput, became unconscious After three hours brought to Cook County Hospital, semi-conscious Odor of alcohol on breath Pulse 68, weak Respiration 20 Temperature 98°, rectal Scalp wound 5 cm long over occiput, no depression of bone Pupils equal, no paralysis Patient rapidly gained consciousness At first no abdominal signs were present Not tympanitic or rigid As consciousness returned, pain became intense in epigastrium. Much nausea, but unable to vomit Abdomen grew rigid Tympanitis came on quickly. Great dyspnoea and pain on inspiration Urine negative The left chest was hyperresonant the heart being pushed to right It was evident that the lung was collapsed and that air had taken its place. Cyanosis and dyspnoea increased, and in eight hours the patient died, before operation was deemed possible

Post mortem Brain negative The peritoneal cavity contained a large amount of stomach contents. The stomach was ruptured near its cardiac end on the anterior wall and greater curvature The diaphragm was ruptured into the left pleural cavity with a laceration admitting the hand Through this orifice a large amount of small intestine had been forced, forming a traumatic hernia

nearly filling the side of the chest, thereby causing the tympanitis, resonance and great dyspnoea, possibly also embarrassing the heart. The pericardium was not torn.

CASE 4. E W Andrews (Surg., Gynec & Obst., 1907) Rupture and hernia of diaphragm Laborer sat on ground, with extended legs, leaning against a pile of boards. The pile collapsed and fell upon the man He was found, knees touching shoulder, head between knees, unconscious. Brought to hospital 4½ hours later in collapse. Strong man, 28 years old Temperature 36°. Complaints of dyspnoea and pain in left chest No fracture of the ribs. Tympany and percussion over left chest from clavicle downward This obscured cardiac dullness completely From seventh rib downward to ninth rib absolute dullness, passing from sternal line into the region of splenic dullness Pulse 68 Abdomen soft, not rigid or sensitive to pressure, except slightly in region of stomach Heart tones pure, regular, weak At 10 P M, somewhat better. Temperature 37° Dullness had ascended to sixth rib At 4 A M vomiting for the first time Vomited repeatedly Died at 7 A M during severe vomiting spell

Post-mortem. Intestines slightly injected Beneath left costal arch a portion of omentum two fingers wide Stomach not visible. Beneath left costal arch is a tumor of the size of a child's head, covered by the transverse mesocolon Strong traction upon the omentum and organs situated below is of no avail Omentum tears, but cannot be delivered Exploring hand glides into pleural cavity without resistance Air enters simultaneously Pleural cavity filled with two thirds of much distended stomach the middle portion of the transverse colon (but little distended), the omentum and the spleen Stomach and colon show a place where constriction has taken place, the furrow is two fingers wide showing sugillations Left dome of diaphragm has a tear 12 cm in length, beginning anteriorly in mamillary line passing sagittally to dome and ending posteriorly at the middle of the twelfth rib The gap in its centre measures about 4 cm Thoracic and abdominal cavities contain about a cupful of blood. If abdominal organs are released they slowly glide back into the thoracic cavity No other injuries in abdominal organs

CASE 5. Miner Buried under masses of ore. Unconscious at first Recovered soon No vomiting Violent pain in gastric region Pulse small, rapid Hematoma over left chest anteriorly. Sixth to tenth ribs fractured posteriorly and below; slight dullness over lungs. Urine normal, later bloody. Great tendency to cough. Later vomiting Pain over stomach more violent. Respiration very rapid, shallow—forty per minute. Pulse rapid, at times impalpable Great thirst Death after eight hours

Post-mortem: Two thirds of stomach in left thoracic cavity; left lung displaced upward; the

heart displaced backward. Superficial tear in stomach. Intestines much distended; mesentery ecchymotic. One pint of blood in abdominal cavity. Spleen normal. Tear in diaphragm leading directly into pericardial cavity, another tear 3 cm from attachment of diaphragm to ninth rib. Heart intact. Lung tissue normal. Tear of diaphragm on right side. Eight liver ruptures distributed over convexity. Rupture of the right kidney, also left kidney; lower one third almost detached.<sup>1</sup>

CASE 6. Fireman. Buffer accident. Unconscious. Temperature normal. Pulse small and rapid. Dyspnoea. No respiratory sounds over left chest. Swelling in left lumbar region between eleventh rib and iliac crest. Blood in urine. Czerny incision to expose kidney. The diaphragm is found to be torn from its attachments in the axillary line to the extent of 18 to 20 cm. Pericardium and lung are visible. Anterior portion of twelfth rib is fractured. This is removed. Upper one third of kidney torn off. The wound in the diaphragm is closed in such a manner that the inner margin of the diaphragm is attached to the thoracic wall by interrupted sutures. Some pneumonic symptoms, exudation, recovery. Examined one year later, vesicular breathing over both lungs. General condition apparently normal.<sup>2</sup>

CASE 7. Man, 70 years old, tried to evade a kicking horse, fell on his back. A wagon grazed the right chest and lumbar region. Lips cyanotic. Pulse 124, respiration 40. Some emphysema. Third and fourth ribs fractured three fingers' breadth from left sternal margin. Tympanic sound anteriorly on both sides. No heart dullness to be made out. Dullness in flanks. Two days later, hiccough, vomiting, pulse 130, pains in chest. Temperature normal, no sleep. Marked vomiting. No bowel movement. Posteriorly, on left side, metallic sound. Loin dullness begins at fourth rib. Absence of cardiac dullness. Less vomiting on fourth day. Pulse 120. Exitus on tenth day.

<sup>1</sup> Bergmann, *Zentralbl. f. Chir.*, 1900, Bd. 27, p. 1205.

<sup>2</sup> Suter, *Beit z. klin. Chir.* Bd. 46, 1905.

Post-mortem: Rupture of diaphragm in anterior portion on the right side. Tear occluded by omentum. Both lungs lacerated by fractured ribs.<sup>1</sup>

CASE 8. Girl 20 years old. Buried under a large load of sand, covering the lower portion of the body. Large tear in genital region on the right side, from mons veneris to anus. Exitus after a few hours.<sup>4</sup>

Post-mortem: Rupture of diaphragm. Prolapse of stomach and intestines.

CASE 9. Laborer thrown to ground by falling tree. Twenty hours later: grave shock. Pulse 145, soft, thready, severe dyspnoea. Violent pains in left chest, bloody sputum, faecal vomiting, nausea. Tympanic note over base of lung, amphoric breathing, succussion sound. Apex beat two inches to right from normal. Fracture of seventh and eighth ribs posteriorly. Diagnosis: Internal strangulation, possibly diaphragmatic hernia. Laparotomy. Strangulation of loop of gut in wound of diaphragm. Reposition by strong traction. Wound 3 cm long. Heart and lung palpable. Closure of wound by four catgut sutures. Exact coaptation not possible. Recovery.<sup>1</sup>

CASE 10. Boy, 2½ years old, fell from second story on iron fence. Large abdominal wound with intestinal prolapse. Prolapse of stomach and intestine into left pleural cavity. Suture of large wound in diaphragm and stomach. Exitus after a few hours. Suture intact.<sup>1</sup>

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<sup>1</sup> Reumann. *Wien med. Wochenschr.* 1900, No. 16.

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DO THE PARATHYROIDS FUNCTIONATE IN INTRAUTERINE LIFE?<sup>1</sup>

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CARLSON,<sup>2</sup> in examining the urine of a pancreatectomized pregnant dog, found that the post-operative rise of sugar was more delayed and the highest percentage less than in non-pregnant dogs. From this he theorized that probably the pancreas of the foetus might furnish and transmit into the blood of the mother a quantity of internal secretion sufficient for a normal sugar metabolism. Subsequent experimentation proved the correctness of his deductions.

Influenced by his work, I reasoned that probably in parathyroidectomized pregnant dogs, tetany would be delayed till after delivery by a compensatory function of the foetal parathyroids, and, in fact, that the symptoms usually associated with the removal of any organ of internal secretion might be delayed, or at least alleviated in pregnant dogs until post-partum.

In regard to the parathyroids this supposition, however, proved entirely fallacious, as my thyroparathyroidectomized dogs went into tetany earlier and died sooner than non-pregnant ones.

In looking over the literature, I found that somewhat similar work had been done, although not with the same object in view.

Halsted resected one thyroid lobe in a pregnant dog. The operation was followed by tetany, which subsided only with termination of pregnancy.

Verstraten and Vanderlinden performed partial thyroidectomy in a cat. Three years later the animal conceived and died in tetany.

Adler and Thaler<sup>3</sup> found that following partial thyroparathyroidectomy, tetany came on earlier and in a severer form in pregnant than in non-pregnant rats.

Caro,<sup>4</sup> in a great number of experiments, whereby he proves to his own satisfaction that

tetany is due to resection of the thyroids and not the parathyroids, also used some pregnant dogs which I noticed died very soon after complete thyroparathyroidectomy.

His work, founded as it is upon a faulty knowledge of the dog thyroid, is, however, of very doubtful value, unless it could be used to prove just the opposite of his contention, which, I believe, it does.

A few cases in the human have been reported in which partial strumectomy (including of course, the parathyroids), was followed by tetanic convulsions in pregnancy, ceasing only with its termination.

The most interesting of these cases is the one reported by Meiner.<sup>5</sup>

This woman underwent a partial strumectomy in the fourth month of pregnancy, followed on the third day after the operation by tetany, which continued at irregular intervals during the remainder of the pregnancy, ceasing at once after delivery. A few years later, the patient again becoming pregnant, tetany reappeared, followed by abortion and again cessation of convulsions.

Reasoning as above, that the parathyroids of foetal pups might work vicariously in parathyroidectomized mothers, I selected dogs in later stages of pregnancy, possibly within two or three weeks of term. Complete thyroparathyroidectomy was done in all of them, and in order to cause the least possible disturbance, very light ether anaesthesia was given and operation completed as rapidly as was consistent with thorough work.

## DOG I

Was operated 12:30 P. M., October 17, 1911. The animal, after coming out of the anaesthesia, appeared in splendid condition the rest of the day.

October 18th, 8:00 A. M., we noticed slight tremor of the neck, muscles, and front legs. At 11:00 A. M., there was added a spastic condition of all the extremities, but no convulsions; pulse 140; resp. 44, very labored; temp. 101.2°. Abdominal palpation

<sup>1</sup> J. Am. Physiol., xxviii, Oct. 2, 1911.

<sup>2</sup> Ztschr. f. Geburtsh. u. Gynäk., 1908, 62, p. 194-203.

<sup>3</sup> Mitt. u. d. Grenzgeb. d. Med. u. Chir., 1908, 17, p. 447-468.

<sup>4</sup> Archiv. f. Gynäk., 1898, 55, p. 446.

<sup>5</sup> Read at the joint meeting of Chicago Medical Society and South Side Branch, May 15, 1913.

demonstrated fetal movements. Vaginal examination was negative. 5:00 P. M. same

October 19th, 8:00 A. M., no tremor; no spasm; less depression; the dog sits up 5:00 P. M. same.

October 20th, 9:30 A. M., pulse 96; respiration 28; temperature 99.2°; apparently normal 5:00 P. M. same.

October 21st, 8:00 A. M., dog found dead Post-mortem gave evidence of beginning labor. otherwise negative. Weight of mother 8.5 kg. Weight of her thyroids 4.82 gr. Weight of pups 1.5 kg. Weight of pups' glands 1.6 gr.

#### DOG 2

Operation October 25, 1911, 12:16 P. M. 6:30 P. M., good condition with slight tremor of neck muscles

October 26th, found dead Post-mortem negative. Weight of mother 6.4 kg. Weight of her thyroids 4.82 gr. Weight of pups 0.73 kg. Weight of pups' glands 0.7 gr.

#### DOG 3

Operation October 27, 1911, 11:10 A. M. Thyro parathyroidectomy

October 28th, 9:00 A. M., one pup born At times slight tremor and rapid breathing, no spasm, pulse 120; temperature 101.2°, respiration 40 5:00 P. M., some tremor, rapid respiration, second pup born 10:00 P. M., dog in fair condition, one pup born between 5:00 and 10:00 P. M.

October 29th, 10:00 A. M., dog in good condition, slight tremors, another pup born Mother takes the usual care of pup at birth

October 30th, 10:00 A. M., tremor (general) spasms of front legs; pulse 140, respiration short, hurried, 52, temperature 101.6°, two pups born 1:15 P. M., same

October 31st, no tremor, no spasm pulse 104, respiration 24, temperature 101.8°

November 1st, 9:30 A. M., dog dying, killed, post-mortem negative Weight of mother 9.2 kg. Weight of her thyroids 6.10 gr. Weight of pups 1.04 kg. Weight of pups' glands 0.58 gr.

#### DOG 4

November 2d, 3:00 P. M., thyroidectomy, thyroids enlarged and very vascular, apparently a small hematoma in one lobe

November 3d, found dead, five pups living Post-mortem decided hyperæmia of upper part of gut. Weight of mother 14.40 kg. Weight of her thyroids 7.0 gr. Weight of pups 1.04 kg. Weight of pups' glands 4.6 gr.

#### DOG 5

Thyroidectomy November 15th, 10:30 A. M. 5:00 P. M., in good condition

November 16th, 10:00 A. M., tremor of all muscles, no spasms, pulse 120, temperature 101.2° 5:00 P. M., characteristic tetany.

November 17th, 8:25 A. M., dog found dead.

Post-mortem negative. Weight of mother 2.8 kg. Weight of her thyroids 2.6 gr. Weight of pups 0.47 kg. Weight of pups' glands 0.45 gr.

#### DOG 6

Thyroidectomy November 15, 1911, 11:00 A. M., 5:00 P. M., in good condition.

November 16th, 10:00 A. M., tetany (characteristic) Fluoroscopic examination was used in order to determine whether the fetal pups were in tetany, but we were unable to assure ourselves as to whether or not Temperature 101.8°. Dog died at about 12:00 M., was posted at once; six pups dead; temperature of one of these 102°, stomach somewhat contracted. Weight of mother 8.2 kg. Weight of her thyroids 4.15 gr.

#### DOG 7

P Thyroidectomy November 18th, 10:30 A. M. November 19th, 10:30 A. M., general tremor, dog lies down 5:00 P. M., characteristic tetany.

November 20th, 10:00 A. M., tetany; severe, vaginal examination negative. 5:00 P. M., dog found dead, post-mortem negative. Weight of mother 7.6 kg.

#### DOG 8

Thyroparathyroidectomy February 15th, 10:00 A. M., 4:00 P. M., condition good. 8:00 P. M., tremor in neck muscles

February 16th, 8:00 A. M., dog found dead, still warm, four pups dead Post-mortem negative. Weight of mother 9.8 kg. Weight of her thyroids 7.7 gr. Weight of pups 5.70 gr. Weight of pups' glands 1.2 gr.

#### DOGS 9 AND 10

Died within twenty-four and forty-eight hours respectively Records lost

The results in this work were so uniform that I did not deem it necessary to use a greater number of animals

The rapid demise of these dogs, however, made me at first think that probably there was something radically wrong with my technique; so in order to eliminate this factor, I asked Carlson, who is vastly my superior in this work, to operate some of the dogs His two dogs, however, died within twenty-four hours

The convulsions came on very early, but I did not observe, as did Adler and Thaler in rats, that the tetany was more severe than in non-pregnant dogs. The average post-operative life was about two days; five dogs died within twenty-four hours.<sup>1</sup>

In this laboratory, non-pregnant dogs

<sup>1</sup> It is specially interesting to note that dogs No. 3 and No. 9 lived longest (save No. 1), and also bore several pups before death.

lived from five to ten days after thyro-parathyroidectomy. Why this difference in duration of post-operative life in pregnant and non-pregnant dogs? Clearly it lies in the condition of pregnancy; but why?

Is it due to a lessened body resistance incidental to the state of conception, or is the system overwhelmed by deleterious products from the foetus and the placenta that would otherwise be neutralized by the parathyroids? The former is hardly likely as the animal then would probably depart from shock. Immediately following the operation, when entirely out of the anaesthesia, the animal may not show the least disturbance.

The latter supposition is more probable and is supported by the cases and experiments mentioned above, in which partial parathyroidectomy was followed by tetany.

In these cases, the parathyroids were able to control the situation under ordinary conditions, but when the state of pregnancy was added, there was a relative hypofunction; the gland not being able to take care of the added products from the foetus.

*This makes me doubt whether the particular glands in question functionate at all in intra-uterine life. Probably these, and also some other organs, as the lung, are thrown in action only simultaneously with extrauterine existence.*

Should these glands functionate as they do later in life, then there would be no extra material thrown on the parathyroidectomized mother, as each gland would take care of its own pup, and consequently life should not be very much more shortened than in non-pregnant dogs, unless, of course, the whole secret lies in the placenta.

Halsted has shown that thyroid of foetal pups in a partially thyroidectomized mother underwent hypertrophy, supposedly of a compensatory nature. If his experiments were done on mothers with hyperplastic glands, then they are not at all conclusive, as in two mothers with enlarged thyroids of above series, I found all the pups with greatly enlarged glands.

This thyroid enlargement in foetal pups of goitrous mothers thus furnishes a direct evidence of the hereditary origin of

strumæ, at least in early life in some of the canines.

That such compensatory function as described by Halsted does not take place in the parathyroids is very likely, because if it did, then death would not come sooner, but would be at least deferred in pregnant dogs.

It would be of great importance if one could ascertain whether the foetal pups also go in convulsions with the parathyroidectomized mother.

Tetany of the foetus would favor the supposition that the parathyroids were inactive at this early period, but not entirely prove it, as the foetus might be completely overpowered by substances from the maternal blood. Lack of convulsions might possibly mean glandular activity. Carlson and I used the fluoroscope as above, but were unable to make out whether pups were in spasms or not. Probably it could be done in smaller animals. Whether the parathyroids are active at once after birth, or, if not, at what period, could, of course, be demonstrated by thyro-parathyroidectomy of pups at different ages.

I have, so far, done only one a week old. It was found dead in forty-eight hours. No convulsions were seen, but it may have had only one. Other glands should be used for this work, especially the suprarenal one. As I have used only one dog for this work (in a poorly done operation), I can give no opinion. The animal used, however, died sooner than most of those non-pregnant ones on which the same operation has been practiced in the laboratory.

There is no doubt but that the removal in pregnant animals of any organ or sets of organs of an internal secreting or eliminating function would hasten, and possibly intensify the symptoms ordinarily associated with such removal, unless, of course, compensated for by vicarious organic function in the foetal pups. (Such compensating function would, of course, be of no avail when it concerns organs of elimination.)

The post-operative life of pregnant thyro-parathyroidectomized dogs should, it seems to me, bear some relation to the stage of conception.



The earlier in pregnancy, the longer death should be delayed, as then a less amount of extra products would be thrown on the mother than later in pregnancy, when the animal, as is seen from above, may become rapidly overpowered by an excess of non-neutralized substances, of the nature of which we know absolutely nothing, and the presence of which we surmise only by their powerful and destructive symptomatic manifestations.

The results in this work may, in a measure, support the parathyroid theory of eclampsia without by any means proving it. It was interesting to note that in the pups of this series, the left gland was almost invariably the larger and heavier, exactly the opposite from the condition in the adult.<sup>1</sup> The relation between glandular and body weight in the pups of mothers with enlarged thyroids was as low as 1-130, whereas in other pups from non-goitrous mothers, from 1-1000 to 1-2000.

The relation between the body weight of the mother and that of her glands averaged 1-180 and in the pups 1-10.49. Thus the

glands of the pups were relatively slightly larger. The relation between the weight of the glands of the mother and of those of the pups averaged 1-8.

Careful microscopic examination is being made of each gland, but as the work is not yet completed, it will be reported in a subsequent paper.

#### CONCLUSIONS

1. Thyroparathyroidectomized pregnant dogs (in later stages) seemingly go in convulsions earlier and die sooner than non-pregnant dogs.

2. In thyroparathyroidectomized pregnant dogs, foetal parathyroids probably do not then compensate for the mothers' glands.

3. Possibly some glands of internal secretion do not functionate in intrauterine life.

4. Undoubtedly, the earlier in pregnancy thyroparathyroidectomy is performed, the longer the post-operative life.

5. The results in this work may in a sense support the parathyroid theory in eclampsia.

6. Direct evidence of heredity as an etiological factor in goiter is shown in this series.

7. In foetal pups, left thyroid gland is almost always the larger.

<sup>1</sup> Werdel, *J. Am. M. Ass.* 1910, p. 449.  
Werdel, *Surg., Gynec. & Obst.* Aug. 1910, p. 157.

## THE INFLUENCE OF MYOMATA ON THE BLOOD SUPPLY OF THE UTERUS, WITH SPECIAL REFERENCE TO ABNORMAL UTERINE BLEEDING<sup>1</sup>

BASED ON THE STUDY OF 150 INJECTED UTERI CONTAINING THESE TUMORS

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THE purpose of the present article is to show the blood supply of uteri containing myomata, with reference to the changes caused in it by these tumors, and especially those which would lead to abnormal bleeding, as found in the clinico-pathological study of 150 injected uteri containing myomata.

At the last meeting of the American Gynecological Society, held at Atlantic City, May 24, 1911, I presented a paper entitled "The

Blood Supply of Uterine Myomata (Based on the Study of 80 Injected Uteri Containing These Tumors)." This paper, which included a study of twenty more injected specimens, was presented before the second annual session of the Clinical Congress of Surgeons of North America on November 15, 1911, and appeared in the *Transactions of the American Gynecological Society for 1911*, and in *SURGERY, GYNECOLOGY AND OBSTETRICS*, March, 1912.

<sup>1</sup> Read before the American Gynecological Society, May 28, 1912.

The present study is a continuation of the previous one, and is of greater clinical value, because the changes in the circulation of the uterus caused by these tumors contribute more to their symptomatology and interfere more with the health of the individual than the blood supply of the tumors themselves.

The literature of this subject, based on the study of injected specimens, is meager and has already been referred to in the previous paper.

The material for the present study consisted of the 100 injected uteri containing one or more of these tumors which were used in the preparation of the previous paper, and 50 additional ones, all of which were removed at operation and injected soon afterwards.

The injection mass used was 15 per cent gelatin which contained in suspension either a pigment or some material (usually bismuth subcarbonate) which was impervious to the X-ray. In 52 specimens, either the arteries or veins, or both, were injected with a pigment (if both were injected, Venetian red was used for the arteries and ultramarine blue for the veins). In the remaining 98 specimens, one vascular system was injected with a mass impervious to the X-ray, and the other system was usually injected with a colored mass. Stereoscopic radiographs of the specimens injected with the mass impervious to the X-ray were found to be of great value in the study of the various phases of this subject.

The material for this study may be grouped according to the clinical diagnoses made before the operation, as follows. Myomata, 79, pelvic inflammatory conditions, 20, uterine bleeding of obscure origin, 16, ovarian cysts, 12; carcinoma of the cervix, 8, carcinoma of the body, 5, descensus and retrodisplacements of uterus, 5, ectopic pregnancy, 3, hydatiform mole, 1, sarcoma, 1. This shows how frequently myomata are encountered when operating for other conditions, i. e. over forty-seven per cent of the material was obtained at operations which were undertaken for other conditions than myomata.

#### THE BLOOD SUPPLY OF THE NORMAL UTERUS

The course of each uterine artery along the side of the uterus and its free anastomosis

with the ovarian artery of the same side are well known (Fig. 1). From each uterine artery branches arise, at intervals, which penetrate the uterus; each one either divides into two branches, one supplying the anterior and the other the posterior uterine wall, or without dividing it supplies either one or the other uterine wall. At the level of the internal os their course within the uterus is at right angles to the long axis of that organ; below this level it is inclined downward, while above it is directed obliquely upward and the arteries themselves are larger. Frequently one intramural artery is much larger than the rest and appears as a terminal branch of the main uterine artery. This is known as the fundal branch. These arteries present many minor variations, but the general plan of their origin and course is the same. These main intramural arteries which I have called "arcuate" lie between the outer and middle third of the uterine wall, and each one supplies a quadrantal segment of the uterus corresponding to a segment of either the anterior or posterior half of the Müllerian duct of that side (Fig. 2). They terminate in median peripheral and radial (centripetal) branches. The peripheral terminal branches of some of the arcuate arteries of one side anastomose freely with similar branches of arcuate arteries of the opposite side, thus establishing a free communication between the two main uterine arteries. Along the course of each arcuate artery, *radial* (centripetal) and *peripheral* (centrifugal) branches arise. The radial branches are the larger and more numerous. They supply the *myometrium*, mesial to the arcuate artery from which they arise, and *terminate in the endometrium*. The peripheral arteries nourish the peripheral portion of the *myometrium*. There is a free anastomosis of the arterioles of the peripheral branches of neighboring arcuate arteries of the same side, and also of the arterioles of the radial branches near their origin from the arcuate artery, but the distal portion of the radial arteries are apparently end arteries.

The arterial system of the uterus enables us to divide the uterine wall into three zones: first, the peripheral (the outer third), which is nourished by the peripheral arteries; second,

the arcuate, the narrow zone in which the arcuate vessels lie; and, third, the radial (the inner two thirds), which is nourished by the radial arteries.

In order to distinguish the arteries from the veins, an injection mass of sufficient coarseness was used so that it usually did not escape through the arterial capillaries into the veins, and as a result I may have failed to inject some of the finer capillaries of the endometrium. The fine terminal branches of the radial arteries penetrate the base of the endometrium, and arterial capillaries were found to extend only a short distance in the uterine mucosa. On the other hand, the veins of the endometrium (the venous capillaries) are easily injected through the uterine and ovarian veins. Occasionally the arterial injection mass escaped from the terminal branches of the radial arteries into the venous plexus of the endometrium, and these specimens presented a very confusing picture, as the arteries and veins contained the same mass, and even if the arterial mass was followed by a venous one of another color the arterial mass remained in the veins of the endometrium.

The arrangement of the venous system of the uterus is as follows (Fig. 3). First, a rich plexus in the endometrium, which is fed by the terminal branches of the radial arteries to which reference has been made, second, a similar but larger plexus of the myometrium, which communicates with that of the endometrium by venous channels. There is often a narrow zone of the myometrium about the endometrium which is relatively anæmic (under normal conditions), and through which the venous channels pass, uniting the two plexuses. This "protection" zone is possibly an important means of regulating physiological as well as pathological uterine bleeding, as will be considered later. About the periphery of the myometrium, especially on the sides, and sometimes accompanying the arcuate arteries, are collecting veins which convey the venous blood of the uterus to the uterine veins situated between the layers of the broad ligament. Since the entire venous system of the uterus is easily injected through the uterine and ovarian veins, the *intrinsic uterine veins* do not contain valves.

The study of the uterine circulation from the injected specimens, bearing in mind that there are not any valves in the veins and that the uterus is a muscular organ which may relax and contract, suggests that the relaxations and contractions of the uterus may be of great importance in aiding its circulation; i. e., the uterus is essentially a "pelvic heart" (Theilhaber). This "cardiac" function is seen during pregnancy and menstruation and possibly may occur during the quiescent non-pregnant condition, although I have not been able to obtain any definite proof of the latter. When relaxed the plexuses of the endometrium and myometrium would be filled with venous blood and the arterial blood would easily gain access to the endometrium, and in contracting, this blood would be forced out of the uterus into the pelvic veins. My studies support the views of Theilhaber in regard to the importance of the muscular efficiency of the uterus in aiding the uterine circulation and in regulating uterine bleeding.

During pregnancy the uterine arteries increase in size, and the arcuate arteries whose radial branches nourish the placenta become hypertrophied. The venous plexus of the myometrium is distended with blood when the uterus is relaxed. On account of the increased vascularity of the organ as a whole, the demand for its "cardiac" function is greater than in the non-pregnant condition, and it is in pregnancy that the intermittent contractions are most noticeable. After labor the process of involution occurs, and Goodall<sup>1</sup> believes that the uterus renews all of its arteries, the renewal consisting in the building of a new vessel within the lumen of the old one.

Adler and Hitschmann have divided the menstrual cycle into four periods: the post-menstrual, interval, premenstrual and menstrual. At the post-menstrual period they describe the endometrium as thin, anæmic and smooth. It gradually increases in thickness as the individual approaches menstruation, and at the premenstrual period it is thicker and more vascular than at any other time. By the process of menstruation the endo-

<sup>1</sup>Am. J. Obst., N. Y., 1900, 62:1-5.

metrium assumes the post-menstrual condition

It would also seem that the entire uterus contained more blood in the premenstrual period, and that menstruation may be looked upon as a form of labor, followed by a process of involution differing in degree from post-partum involution

I have studied all my specimens with a knowledge of the age of the patient, and the date of the last menstruation if operated upon before the menopause, and have injected several specimens from patients who were menstruating at the time of the operation. I have found that the endometrium differs so much in its thickness and vascularity in individual cases that it is impossible to determine the exact stage of the menstrual cycle from the appearance of the endometrium except during the actual flow. I have seen the endometrium thick and very vascular within a week after the menstrual period, and relatively thin in the premenstrual period. It must be borne in mind that the degree of congestion during life cannot be determined from the injected specimen; nevertheless my work in a general way confirms the descriptions of Adler and Hitschmann as to the changes of the endometrium in the various phases of the menstrual cycle. As a woman approaches the menopause the uterus becomes less vascular, both arterial and venous, the endometrium and uterine wall become thinner, and the proportion of the muscle to connective tissue changes in the wall, the connective tissue predominating. I believe that injected uteri can only be intelligently studied when both the age of the patient is known and the date of the last menstrual period, irrespective of the pathological condition present.

#### THE FACTORS REGULATING MENSTRUATION

In the present communication we are specially concerned with the vascular changes in the uterus leading up to and associated with menstruation. What causes the onset of the flow? Why does it continue for a certain number of days? Why does it stop? Why irregular or regular, scanty or profuse, of short or of long duration?

#### OVARIAN FUNCTION AS A FACTOR IN REGULATING MENSTRUATION

We know that ovarian activity or function is responsible for the menstrual cycle. If the ovaries have been entirely removed, the changes in the uterus leading to menstruation do not take place, and physiological uterine bleeding will not occur.

On the other hand, ovarian activity may normally exist, and yet the individual may not menstruate, as shown by women becoming pregnant before puberty, during the amenorrhoea incident to lactation, after the apparent menopause, and in those with suppression or absence of menstruation due to other causes. A non-pregnant woman then, with apparently normal ovarian function *as far as ovulation is concerned*, may not menstruate. If she does not, its non appearance is due to some condition within the uterus, or even outside. I have long been impressed with the fact that patients with abnormal menstruation, either irregular, scanty, profuse, or prolonged, may have ovaries which anatomically and histologically appear normal. We also find extensive pathological condition of the ovaries, especially large cysts, in patients with normal menstruation. We must conclude that the influence of the ovaries on menstruation, both as regards its periodicity, the duration of the flow, and the amount of blood lost whether scanty or profuse, is not so much dependent upon the anatomical structure of the ovaries, which we are able to detect, as upon their functional activity and the interrelation between this and the uterus, and the influence of other factors which we have not yet definitely determined. Here again, as will be shown, the functional activity of the uterus plays an important part in regulating the amount of blood lost, and the latter is not dependent entirely upon anatomical changes which we can detect.

#### THE ENDOMETRIUM

The menstrual flow occurs as an escape of blood from the endometrium into the uterine cavity. A study of the injected specimens shows us that the distal portion of the radial arteries terminate in the endometrium, and that these branches are very small, and the

capillaries supplying the uterine mucosa are very difficult to inject with the material I have used (Fig. 2). On the other hand there is a rich venous plexus in the endometrium, whose blood is carried by venous channels to the venous plexus of the myometrium (Fig. 3). If a uterus, removed from a patient who was menstruating at the time of the operation, was injected, the arterial injection mass did not escape into the uterine cavity *but the venous injection mass always did*. This we would expect from the study of injected uteri removed in the intermenstrual period. From my studies I would infer that *the normal menstrual flow is entirely a venous hemorrhage from the venous plexus of the endometrium, and it is only possible when there are changes in this plexus which will permit the blood to escape*. I offer as proof of the latter statement that I have never seen the injection mass escape into the uterine cavity unless the patient was flowing (either physiologically or pathologically) at the time of the operation, or else just before or after such a flow. The venous plexus is very strong during the intermenstrual period, for I have often purposely used great force, and yet the injection mass did not escape into the uterine cavity. When the injection mass escaped, it occurred either in the form of oozing from the portion of the venous plexus just beneath the endometrial epithelium, or a "hæmatoma" of the mass formed in the endometrium, with subsequent rupture of the portion of the mucosa over it, permitting its escape into the uterine cavity (Figs. 4 and 5).

Adler and Hirschmann state that the endometrium is thicker just before menstruation than at any other time, and that this thickness is due to actual hypertrophy, with marked glandular hypertrophy and increased vascularity. As changes in its venous plexus are necessary for the escape of the blood and as there is often a marked glandular hypertrophy at this time, suggesting an increased glandular activity, the views expressed by Frankl<sup>1</sup> that menstruation is a biochemical process dependent upon a ferment produced by these glands, which ferment alters the venous plexus or portions of it, thus permitting an escape of blood, seems possible.

It would be expected that the thicker and the more vascular the endometrium, the greater the flow, but this does not necessarily follow. I have seen specimens removed during the interval and premenstrual period with a very thick and vascular endometrium, and yet the patient gave a history of a moderate menstrual flow; and other specimens removed under similar conditions showed a much thinner endometrium, and yet menstruation was very profuse. The type of menstruation is not entirely dependent upon the character of the endometrium, here again functional activity plays an important part and the degree of this activity cannot always be detected from the anatomical structure.

It is generally considered that under normal conditions the menstrual blood will not clot. In other words, the endometrium receives coagulable blood and it escapes in a non-coagulable state. The endometrium is supposed to secrete some substance which inhibits clotting. Sturmdoff believes that this is an important local hæmatological factor in the causation of uterine bleeding. The discussion of this phase of the subject and references to the literature may be found in his article.<sup>2</sup> I obtained careful menstrual histories in regard to clotting from 100 women who either were not suffering from any pelvic disorder at the time, or the history applied to the character of their menstruation previous to their pelvic trouble. Sixty-five gave a history of no clotting; the flow was scanty in 15, moderate in 44, and profuse in 6. Thirty-five gave a history of clotting, the flow was scanty in 2, moderate in 8, and profuse in 25. Of the 100 cases, the menstruation was scanty in 17 (no clotting in 15, and clotting in 2), moderate in 52 (no clotting in 44, and clotting in 8), and profuse in 31 (no clotting in 6, and clotting in 25). It would seem that patients with a scanty or moderate flow were not likely to have clots (59 out of 69), while those with a profuse flow were likely to (25 out of 31). This is in accord with the findings in the injected specimens; if the flow is profuse the endometrium does not have an opportunity to act upon it and much of

<sup>1</sup>Archiv f. Gynäk. 1911, 200-203

<sup>2</sup>N. Y. S. J. Med., 1911, 11, 1161-64

it is probably a reflux (no valves in the veins) from the rich plexus of the myometrium. While the action of the endometrium on the blood (inhibiting its power to clot) may be an important factor in the onset of the flow, it would seem to me that it may have but very little influence in the causation of profuse menstruation.

#### THE MYOMETRIUM AS A FACTOR IN THE CONTROL OF MENSTRUATION

In considering this we must also include its blood-vessels, and especially the rich venous plexus into which the endometrial venous plexus empties. We are all aware of the fact that contraction of the uterus will cause endometrial hæmorrhage to cease, and relaxation of the same will make it more profuse. We have the opportunity to observe this not only postpartum, but also when curetting the uterus especially for an incomplete abortion — the uterus will often dilate, leading to a profuse hæmorrhage, and the contraction of the uterus will cause the bleeding to cease.

Following curettement of the uterus, the bleeding soon ceases. The question naturally presents itself, Why is not the usual curetting for sterility etc., followed by prolonged bleeding (mimulating the menstrual flow)? The endometrium and its blood-vessels have been injured. I have injected only one uterus in which there had been a curetting as the first step in the operation. In this specimen both the arterial and venous injection masses escaped into the uterine cavity, showing that both the arteries and veins of the endometrium, and also possibly some of those of the myometrium, had been injured, yet had the uterus not been removed the bleeding would soon have ceased. A study of injected specimens will convince one that contractions of the uterus would easily compress not only the venous channels leading from the endometrium, but also the distal branches of the radial arteries, which supply the endometrium and are very small. The latter, after being severed, may also retract within the musculature, due to their elasticity, and soon cease to bleed. Contraction of the uterus would also compress the endometrium and make smaller the uterine cavity. The

myometrium is apparently an important factor in the control of physiological uterine bleeding.

We have discussed the influence of ovarian activity on the menstrual cycle as manifested in the changes occurring in the endometrium. The study of this phase of the subject is relatively easy, but the study of the changes occurring in the myometrium is more difficult. It is supposed that the uterus contains more blood just prior to the menstrual flow, i. e., it is "congested." I have endeavored to prove this, but there is so much individual variation in the specimens removed that I have been unable to tell, by the appearance of an injected myometrium, at what stage in the menstrual cycle the uterus was removed, just as I have been unable always to determine by the appearance of the endometrium (except during the actual flow) what stage of the menstrual cycle it presents. Nevertheless my studies have led me to believe the venous plexus of the myometrium is capable of containing more blood just before the menstrual flow than at any time, and possibly more blood may be carried by the arteries to the uterus. The greater the relaxation of the uterus, the more blood it will contain. We would naturally suppose that the greater "the uterine congestion" the greater the menstrual flow, but this is not invariably true. The plexus of the myometrium may be greatly dilated, and yet the flow is not necessarily profuse, as may be seen in some of the uteri containing intramural myomata, which are not necessarily associated with profuse menstruation. *It is not the amount of blood within the uterus or pelvic veins which determines the amount of blood lost at the menstrual flow as much as the control of this blood, i. e., the ability of the uterus to hold back the venous blood.* A great factor in preventing the escape of this blood into the uterine cavity is the tonicity of the uterus. It would seem that during relaxation of the uterus at the menstrual period the venous blood escapes into the uterine cavity, and during contraction of the uterus the flow is retarded by occlusion of the cavity and compression of both arteries and veins, but the blood which has escaped into the uterine cavity

ity is forced out through the cervix. If the endometrium is intact, bleeding will not occur during relaxation of the myometrium. This may be observed during pregnancy, when the uterus is frequently relaxed, and I have observed it during curettage; the dilatation of the cervix may cause uterine relaxation, as shown by the length of the uterine cavity, and yet bleeding does not occur until the endometrium is injured.

My studies have led me to believe that the myometrium is a very important factor in the regulation of the menstrual flow. It may receive stimuli from many outside sources, the most important of which is probably the ovary.

As women grow older all the pelvic generative organs become less vascular and less active. The arterial system of the uterus becomes physiologically sclerotic, the venous plexuses atrophy, the endometrium becomes thinner and anæmic, the muscles of the myometrium atrophy, and the proportion of fibrous tissue increases and the entire organ becomes smaller. Under normal conditions menstruation becomes gradually less and finally ceases. Under abnormal conditions of uterine inefficiency, and here I believe with Theilhaber, that the most important single factor is muscular insufficiency, menstruation may become prolonged and more profuse, and there may be irregular or intermenstrual bleeding.

#### SUMMARY

As a result of ovarian activity the uterus of the sexually active woman becomes periodically hyperæmic, the height of hyperæmia (congestion) occurring in the premenstrual period. The endometrium undergoes functional active changes, often manifesting themselves by hypertrophy, especially glandular, hyperæmia, and œdema. The onset of menstruation is established by changes in the venous plexus of the endometrium, permitting the blood to escape into the uterine cavity. The continuation of the flow is probably made possible by several factors; such as ovarian activity, the continuation of the uterine conditions which established it, and the time necessary for the regressive changes to occur and repair to take

place. Menstruation then is associated with and followed by a process which may be called involution.

The amount of blood lost is determined by many factors and their interrelation, such as ovarian activity, the anatomical and functional changes in the endometrium and myometrium, and influences other than ovarian outside the uterus. Of all these factors, I believe that the muscular efficiency of the uterine wall must play an important part, for this is the only means of closing the uterine cavity and of controlling the venous channels which unite the plexus of the endometrium with that of the myometrium, and also the arterial blood conveyed to the mucosa. The "protective zone" (anæmic) through which the terminal portion of the radial arteries and the venous channels pass would be the portion of the uterus most readily compressed by uterine contraction.

#### THE CLASSIFICATION OF UTERINE MYOMATA

Myomata may arise in the body of the uterus, the usual situation, or in the cervix. They may be grouped topographically into the *intramural*, the *subserous* (including *intraligamentary* and *retroperitoneal*), and the *submucous* (the usual classification). We may also group them according to the source of their main arterial supply, into *peripheral* and *radial*. A *peripheral* myoma is one arising in the peripheral zone of the uterus and receiving its chief or sole arterial supply from a peripheral branch of an arcuate artery. All peripheral tumors are either intramural, subserous, intraligamentary, or retroperitoneal. A *radial* myoma arises in the radial zone and receives its chief or sole arterial supply from a radial branch or branches of an arcuate artery. All radial tumors are primarily intramural. They may persist as such, or eventually become subserous or submucous. When they do so they carry their nutrient artery or arteries with them.

These tumors may also differ morphologically. A myoma may be simple, that is unimodular, or compound. In the latter case it may be referred to as conglomerate or multinodular. It may be discrete, with sharply defined limits, or diffuse, merging

gradually into the surrounding tissues. We must also consider a somewhat unusual form, the adenomyoma, in which areas of uterine mucosa are found.

In studying the influence of myomata on the circulation of the uterus, we must consider in each case the variety of myoma or myomata present, their blood supply, the age of the patient, and if before the menopause at what stage of the menstrual cycle the uterus was removed. It is often difficult to study the influence of each variety on the blood supply of the uterus, because usually several myomata are present in each specimen, and often representing several varieties.

In the 150 uteri containing myomata, multiple tumors were found in 144. The following classification of this material may be made.

Small peripheral myomata projecting from the surface of the uterus, which may be designated as subserous, were encountered in 83 specimens. In only one specimen was only one myoma found, in all the others intramural tumors were also present.

Large pedunculated myomata 10 cm in diameter (the largest being 22 cm) were encountered in only three specimens, and these were all associated with intramural myomata.

Small intramural myomata, either peripheral or radial, were found in 146 of the uteri removed, and in only two instances was only one tumor present.

Medium size (2.5 cm or over) and large intramural myomata were found in 76 specimens, and in three only was a single tumor present.

Submucous myomata (i. e., over half the circumference of the tumor projecting into the uterine cavity) were found in 16, and all were associated with other varieties of myomata.

Adenomyomata were found in 12, and all were associated with other varieties.

Only one definite cervical myoma was found, but two others were encountered while I was collecting this material, but were not injected, as the tumors were removed without removing the uterus.

#### THE BLOOD SUPPLY OF UTERINE MYOMATA

All myomata, except some of the very small ones, have an arterial blood supply which can be easily seen with the naked eye. As they increase in size they become more vascular (arterial), so that the medium size and large ones contain more vessels filled with the arterial injection mass than the myometrium. The vessels filled with the venous injection mass are usually few in numbers and in some specimens, even large tumors, I have been unable to demonstrate any "veins" in the substance of the tumor. This is in marked contrast to the myometrium, where the venous supply predominates over the arterial.

The arterial blood is carried to these tumors by means of nutrient arteries which are either peripheral or radial branches of an arcuate artery, hence myomata may be grouped as either peripheral or radial. In many only one nutrient artery is found; in others two or three, with one predominating. The branches of the nutrient artery extend over the surface of the tumor and penetrate its substance thus supplying the intrinsic "arteries" of the tumor, which I have stated are often much more abundant than those in the myometrium and differ in their arrangement, etc. (See previous article on the blood supply of uterine myomata.) Often the only communication found between the arteries of the tumor and those of the myometrium is by the nutrient arteries. In some of the medium size and large tumors, an anastomosis was found between the arterioles of the myometrium about the tumor and similar vessels in the periphery of the myoma. When the tumors change their position their nutrient artery accompanies them. In many of the medium size and larger myomata the development of their intrinsic arteries is so great that the injected specimen appears as an arterial angioma rather than a myoma.

The myomata, as already stated, are usually poorly supplied with veins in their substance, and in some specimens I have not been able to demonstrate any. I have proven in some, that the arterial blood gains access to veins in the substance of the tumor, i. e., where the latter are present; but where veins



cannot be demonstrated we must assume that this occurs about the periphery of the tumor, or else the arterial blood leaves the tumor as such and gains access to veins in the surrounding myometrium. The enormous number of arteries in the tumor and their tortuous course, together with the apparent inefficient venous outlet, suggest that the circulation of the blood within the tumor is sluggish. For further description of the blood supply of these tumors, see previous article on the subject. On account of the great vascularity of many of these tumors, we must look for other changes in the circulation of the uterus than those caused by the mechanical influence of the tumor or tumors.

#### SMALL SUBSEROUS MYOMATA

##### *Changes Caused by Them in the Circulation of the Uterus*

I have included in this group all myomata under 2.5 cm. in diameter projecting from the surface of the uterus for over one half their circumference, and that covered only by peritoneum. As stated, this variety was found in 83 specimens, and in only one specimen was but one myoma present. In all the others intramural myomata were found. A study of the injected specimens shows that the branches of the nutrient artery of the tumor spread over the surface of the tumor from its base, and thence penetrate the substance of the tumor. The tumors of this size, while containing intrinsic arteries, are usually less vascular than the myometrium. Veins are found over the surface of the myoma, but it is usually impossible to demonstrate any within its substance. Aside from a slight increase in size of the peripheral artery from which the nutrient artery arises there is not any apparent change in the arteries of the uterus, and the same is true of the veins. The study of the injected specimens supports the clinical findings in these cases, i. e., small subserous myomata do not disturb the circulation of the uterus and do not alter menstruation. The same was found to be true of the medium size subserous myomata (2.5 to 10 cm. in diameter), of which 11 were studied

#### LARGE SUBSEROUS MYOMATA (OVER 10 CM. IN DIAMETER)

##### *Changes Caused by Them in the Circulation of the Uterus*

Only three such specimens were present in this series: one was associated with several intramural myomata, small and large, and a submucous myoma, and therefore was not adapted to the study of this phase of the subject. The other two also contained several intramural and subserous myomata, but fortunately they were of small size. In one of these two the subserous tumor was 10 cm. in diameter, very vascular, and derived its chief blood supply from one uterine artery (Fig. 9). This artery was enlarged, and it could be seen in the radiograph that the excess blood supply over the normal was diverted from the uterus to the tumor. The body of the uterus was not enlarged, the arterial supply was not increased, but rather appeared less than normal, suggesting that the tumor might receive more than its share of arterial blood. Large veins were present in the pedicle of the tumor, and the venous blood was carried from the tumor by means of large venous channels in the peripheral zone of the uterus (Fig. 10). From a study of the specimen one would suppose that the tumor would not influence menstruation, and such was the history of the case — menstruation regular, normal, and moderate. The second specimen was larger, the tumor, measuring 22 cm. in diameter, arose from the middle of the posterior wall of the uterus, and was therefore nourished by both uterine arteries. Both uterine arteries were greatly enlarged, and what has been said about the previous specimen can also be said about this one (Figs 7 and 8). Menstruation in this patient had always been profuse but had not increased in amount or duration. These two cases show that while these tumors alter the arteries from which their nutrient arteries arise, and give rise to large venous channels in the pedicle of the tumor and in the peripheral zone of the uterus, the radial zone is unaffected, and we would expect that menstruation would usually not be altered; and such has been our clinical experience.



Fig. 1. Radiograph of the arterial supply of the entire uterus. N. 1. Nullipara, aged 25, arteries injected with bi-smuth subcarbonate autopsy specimen. The course of each uterine artery is shown along the side of the uterus and from these the intrinsic uterine (arcuate) arteries arise.



Fig. 2. Arterial supply of the uterine tissues. N. 1. Radiograph of a cross slice 1 mm. thick of the body of the uterus. Nullipara, aged 44, arteries injected with bi-smuth uterus removed for chronic pelvic peritonitis. The arcuate arteries, the large arteries and a small portion of a third two of which appear in the illustration pass between the outer third and inner two thirds of the uterine wall and terminate, in the mesh in line in radial and peripheral branches. They divide the uterine wall into two zones—the outer or peripheral zone which is nourished by peripheral branches of the arcuate arteries, and the inner or radial zone which is nourished by radial branches the latter terminating in the endometrium by fine capillaries. Each arcuate artery, with its peripheral and radial branches supplies a quadrantal segment of the uterus corresponding to the anterior or posterior half of the Mullerian duct of that side. When the uterus is relaxed arterial blood would easily gain access to the endometrium, but when contracted it would seem that the terminal arterioles and capillaries of the radial arteries would be easily compressed.

Some of the large venous channels in the pedicle of the tumor are very superficial, and similar channels are found about the base of the tumor. One can readily see that these might easily be injured by movements of the tumor and give rise to bleeding into the peritoneal cavity. Such a complication occurred in this series, the injury arising from a bimanual examination of the patient made before the operation.

#### SMALL INTRAMURAL MYOMATA (UNDER 2.5 CM. IN DIAMETER)

##### *Changes Caused by Them in the Circulation of the Uterus*

As has been stated under the classification of uterine myomata, these were found in 146 of the 150 specimens, and only in two instances was only one tumor present. They

were present in all but three specimens where medium size and large intramural myomata were found in all specimens containing submucous myomata, adenomyomata, and medium size and large subserous myomata. This group alone was found in uteri which were removed for the following conditions: pelvic inflammation, 14, including two cases of puerperal infection with portions of retained placenta, uterine bleeding, 16, ovarian cysts, 7, carcinoma of the cervix, 7, carcinoma of the body, 5; retrodisplacements and prolapse, 5 (uterus removed on account of myomata discovered at operation), ectopic pregnancy 3, sarcoma and hydatiform mole, each one. These tumors develop either in the peripheral or radial zone of the uterus, and are either peripheral or radial tumors. I have not counted all the tumors found in the 146 specimens, and so cannot state in which zone they occur most frequently, but apparently in the radial zone, and this would be expected, as it is much the larger zone. All



Fig 3 Venous supply of the uterine tissues. X 1 Radiograph of a cross slice of the body of the uterus as shown in Fig 2. Nullipara, aged 30, veins injected with bismuth through the uterine and ovarian veins. Uterus removed for chronic pelvic peritonitis during the interval stage of the menstrual cycle. There is a rich venous plexus of the endometrium, and also of the myometrium, which communicate with each other by channels which pass through a relatively anæmic zone. Collecting veins are present about the periphery of the myometrium, especially at the sides (and, at times, accompanying the arcuate arteries), which convey the venous blood to the uterine and ovarian veins. Valves are not present, and therefore when the uterus is relaxed the venous blood in the myometrium could easily be forced back into the plexus of the endometrium, and if the latter was injured (physiologically or otherwise) it would escape into the uterine cavity. Contraction of the uterus would make the uterine cavity smaller, compress the endometrium, and force the venous blood of the latter into the myometrium and thus prevent bleeding into the uterine cavity. This is in accord with clinical observations.



Fig 4 Venous supply of the uterine tissues. Close of menstruation. X 1 Radiograph of a cross slice of the body of the uterus, as in Fig 3. Nullipara, aged 31, veins injected with bismuth. Uterus removed, at the close of menstruation, for chronic pelvic peritonitis with bilateral ovarian cysts. The injection mass does not escape into the uterine cavity except during the menstrual flow or just before or just afterwards—showing that changes in the walls of vessels of the endometrium are essential for the flow. I have never been able to force the arterial mass into the uterine cavity at this time, but always the venous, and never the latter except at the above mentioned times. This demonstrates that the menstrual flow is mainly, if not entirely venous. We would expect this from the study of our specimens. Compare Figs 2 and 3.



Fig 5 Venous supply of the endometrium. Close of menstruation. X 4 Enlargement (X 4) of a portion of the radiograph shown in Fig 4. The menstrual flow arises from the venous plexus of the endometrium and escapes either into the tissues of the latter, forming a hematoma, and thence into the uterine cavity, or it escapes directly into the cavity from the superficial portion of the endometrial venous plexus. See black mass in uterine cavity. As stated, changes in this plexus are essential for the menstrual flow. Contraction of the uterus would compress the endometrium and the terminal branches of the radial arteries (see Fig 2), and also force the venous blood out of the uterus, and therefore lessen the flow. Relaxation of the uterus would permit the arterial blood to more readily reach the venous plexus of the endometrium, and, as there are not any valves in the veins, the venous blood of the myometrium could be easily forced back into the endometrium, and therefore make the flow more profuse.



Fig 6 Venous supply of the endometrium. Interval stage of the menstrual cycle. X 4 Enlargement (X 4) of a portion of the radiograph shown in Fig 3, to be compared with Fig 5, showing menstruating endometrium.



Fig. 7 Subserous myomata, changes in the arterial circulation of the uterus. Slightly reduced in size. Radiograph of a cross slice, 1 cm. thick, of the body of the uterus and a portion of a large subserous myoma with its pedicle. Nullipara, aged 31, arteries injected with bismuth. The uterus contains several small subserous and intramural myomata. The large subserous tumor (22 cm. in diameter), arose from the posterior wall of the uterus a little to one side of the median line, and has a rich arterial supply. A small subserous myoma, 1.3 cm. in diameter, is attached to the anterior uterine wall. Its nutrient vessels are small and have very little influence on the arterial circulation of the uterus. The main nutrient artery of the larger tumor, a peripheral branch of an arcuate artery, together with the latter, is greatly enlarged. The arcuate artery of the opposite side, which anastomoses with it, is also enlarged. The greater portion of the blood stream from the uterine arteries, especially the one from which the chief nutrient artery arises, is diverted from the uterus to the tumor. The radial arteries of uterus are apparently not increased in size and numbers.

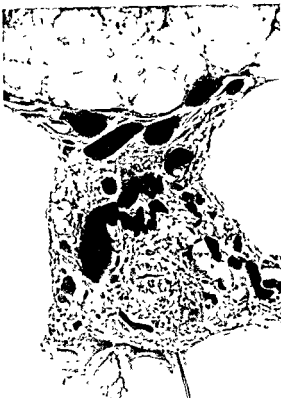


Fig. 8 Influence of the tumor shown in Fig. 7 on the venous circulation of the uterus (menstruation normal but profuse). Photograph of the slice shown in Fig. 7, veins injected with ultramarine blue. The white dots are arteries, containing bismuth, which have been cut across. Uterus removed during the interval stage of the menstrual cycle. Note the dilated veins and sinuses in the pedicle of the tumor and in the peripheral zone of the uterus near the pedicle. The radial zone is but little affected. The endometrium is thickened. A portion of the venous plexus of the peripheral zone of the uterus is converted into venous channels to convey the venous blood from the tumor to the veins between the layers of the broad ligament. The "venous congestion" is apparently active, and, being mainly in the peripheral zone, alters very little the circulation of the endometrium. Menstruation in this patient was always profuse, never excessive, and not increased lately.

these tumors apparently have an arterial blood supply, although I have seen a few very small ones in which it could not be detected in the gross specimen, this may have been due to faulty technique or the section through the tumor may not have exposed any of its vessels. Its nutrient artery, a radial or peripheral branch of an arcuate artery, sur-

rounds the tumor with its branches, and the latter penetrate the substance of the tumor. Intramural myomata of this size are nearly always less vascular (arterial) than the surrounding myometrium. I have usually been unable to find any vessels in their substance filled with the venous injection mass. These tumors apparently do not appreciably alter the arterial circulation of the uterus as a whole unless in large numbers, when the uterine



Fig. 9. Large subserous myoma. Changes in the arterial circulation of the uterus. N. I. Radiograph of one half of the uterus (sagittal section), and of the lower portion of the tumor and its pedicle, arteries injected with bismuth. Nullipara, aged 45.

The tumor, 10 cm. in diameter (the lower portion is shown) arose from posterior wall of the fundus to one side of the median line. A small subserous tumor is situated just below it. The larger tumor is very vascular, and its nutrient artery arises from one uterine artery which is larger than normal, and the greater portion of its blood stream is diverted from the uterus to the tumor.

artery may appear a little larger. Locally the artery supplying its nutrient artery may seem a little larger, and mechanically they displace the arteries in the surrounding myometrium. The venous plexus of the myometrium about the very small tumors is not appreciably changed, but about many of those over 1 cm. in diameter there is often a localized, or even a general dilatation of this plexus, and this increases with the size of the tumor. Sometimes when the larger tumors of this group are present or there are a number of tumors, there is an increase in the size of the uterine wall, due in some instances to an actual hypertrophy of the myometrium and in others to a dilatation of the venous plexus of the myometrium, or both factors (Fig. 13).



Fig. 10. Influence of the tumor shown in Fig. 9, on the venous circulation of the uterus (menstruation normal, moderate). Photograph of a sagittal section of the specimen, veins injected with ultramarine blue. The white dots are arteries, containing bismuth, which have been cut across. Uterus removed during the interval stage of the menstrual cycle. Note the dilated veins and sinuses in the pedicle of the tumor and the upper portion of the peripheral zone of the uterus. The radial zone is but little affected, the endometrium (a small portion shown in the section) is apparently unaltered. A portion of the venous plexus of the peripheral zone of the uterus is converted into venous channels for conveying the venous blood of the tumor to the uterine and ovarian veins. The "venous congestion" is evidently active, not passive, and did not alter the circulation of the endometrium, i. e., the uterus was able to control its venous circulation. Menstruation in this patient had always been normal and moderate in amount.

A study of the injected specimens suggests that these tumors usually do not greatly interfere with the circulation of the uterus and do not alter menstruation, and clinically experience confirms this. Even those with a generally hypertrophied venous plexus of the myometrium do not necessarily have menstrual disturbances (Fig. 13). On the other hand they may indirectly cause menorrhagia or metrorrhagia (Figs. 11 and 12). In 18 uteri



Fig. 11 Small intramural myomata associated with a polypoid condition of the endometrium (menorrhagia) X 1. Photograph of a sagittal section of the uterus. Para, aged 40, hysterectomy for uncontrollable uterine bleeding (drugs and curettage had failed to relieve the patient), patient bleeding slightly at the time of the operation. Arteries injected with Venetian red and veins with ultramarine blue. The arterial injection mass did not escape into the uterine cavity but some of the venous mass did and appeared as an oozing from the surface of the endometrium. The uterus is slightly enlarged and contains several small intramural myomata shown in the peripheral zone one (M) shown in the illustration. The endometrium is hypertrophied and presented an irregular polypoid surface. The venous plexus of the myometrium is not hypertrophied. While small intramural myomata apparently do not alter the circulation of the uterus in the majority of cases, they may possibly sometimes cause changes leading to abnormal bleeding one of which may be a polypoid condition of the endometrium. Compare with the next illustration.

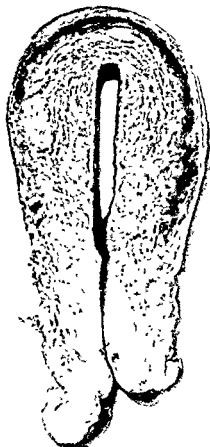


Fig. 12 Small intramural myomata associated with an atrophied endometrium (menorrhagia) X 1. Photograph of a sagittal section of the uterus. Para, aged 41, hysterectomy for uncontrollable uterine bleeding (drugs and curettage had failed to relieve the patient), patient bleeding at the time of the operation. Arteries injected with Venetian red and veins with ultramarine blue. The arterial injection mass did not escape into the uterine cavity but some of the venous mass did, and appeared as an oozing from the atrophic rough endometrium. The uterus is slightly enlarged and contains several small intramural myomata two shown in the illustration. The endometrium is atrophied and rough. The uterine cavity is not dilated. A condition of uterine inefficiency exists. The uterus is unable to prevent the venous blood from escaping into the uterine cavity. Small intramural myomata may possibly cause this condition. The atrophied rough endometrium may be but a stage in the abnormal menstrual cycle, the other stage being represented by a polypoid condition of the endometrium, as shown in the preceding illustration.

removed for obscure uterine bleeding, small intramural myomata were found in 16. The two in which they were not found were nullipara, as were also two of the 16. In 4 of the 16, discrete polypi were found in addition to the myomata, in two others there was a polypoid condition of the endometrium. In the remaining ten, the myomata were the only apparent pathological condition present.

In none of the 16 cases did any of the myomata encroach upon the endometrium. In two of the specimens the uterus was soft, flabby and the plexus of the myometrium hypertrophied,

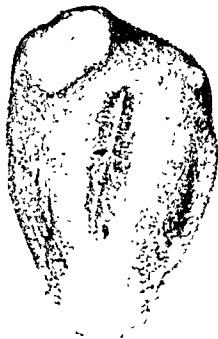


Fig. 13 Small peripheral intramural myomata. Changes in the venous circulation of the uterus (menstruation, normal and moderate). X 1. Radiograph of a median sagittal slice 1 mm thick, of the uterus and the myoma. Para aged 36, uterus removed for chronic pelvic peritonitis in interval stage of menstrual cycle, veins injected with bismuth. The uterus is enlarged, the endometrium hypertrophied and the venous plexuses of both endometrium and myometrium are dilated. Compare with Fig. 3. In spite of the hypertrophied endometrium and increased amount of venous blood within the uterus menstruation was moderate in amount and normal, i. e. the uterus was able to control its increased venous circulation and prevent an excessive flow into the uterine cavity.

in the others the uterus was hard the walls thickened, and the plexus of the myometrium compressed. They represent the two types of uteri associated with abnormal bleeding described by Theilhaber<sup>1</sup> the one due to muscular weakness, i. e. the musculature is unable to regulate an increased hyperaemia due to any cause, or *hypoplasia muscularis uteri*, the other due to an apparent predominance of fibrous tissue, the *myofibrosis uteri* found especially in parous women approaching the menopause. It is not my purpose to discuss the cause of bleeding in these cases,

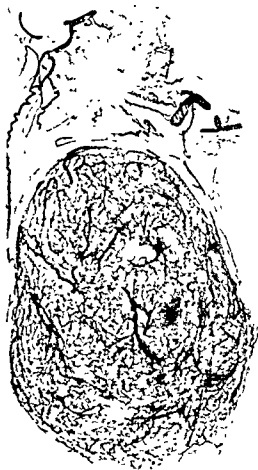


Fig. 14 Large peripheral intramural myoma, its influence on the arterial circulation of the uterus (menstruation, normal and moderate). Slightly reduced in size. Radiograph of a cross slice, 1 cm thick, of the body of the uterus and the myoma. Nullipara, aged 38, arteries injected with bismuth. The tumor, 10.5 cm in its long diameter, arose in the peripheral zone of the anterior uterine wall, and has grown away from the uterus. The uterine artery supplying the tumor is enlarged and the excess over the normal is diverted to the tumor, which is very vascular as in Figs. 7 and 9. The tumor has had very little or no effect on the arterial supply of the radial zone of the uterus and the endometrium. In this slice there is no evidence of any communication between the arteries of the uterus and the tumor. For the nutrient arteries of this tumor see Figs. 10 and 11 of previous article.

as the literature on this subject is voluminous, contributions having been made by several writers in this country, as Lindley, Anspach, Smith, Goodall, and others, but to suggest

<sup>1</sup> Blutungen und Ausfluss aus dem Uterus. Verlag von E. Reinhardt München 1909.



Fig. 15 Influence of the myoma shown in Fig. 14 on the venous supply of the uterus. Photograph of the slice shown in Fig. 14, veins injected with ultramarine blue, uterus removed during the interval stage of the menstrual cycle. The chief changes in the venous supply of the uterus are in the peripheral zone where portions of the venous plexus of the myometrium are converted into venous channels for conveying the venous blood from the tumor, as in Figs. 8 and 10. The endometrium is hypertrophied. Menstruation in this patient was normal and moderate in amount. The uterus was able to control its increased arterial and venous blood supply and prevent an excessive flow of venous blood into the uterine cavity.

that small intramural myomata may in some way contribute to its development. From



Fig. 16 Upper surface of the fundus of the uterus and the myoma shown in preceding illustration. Photograph showing the dilated veins over the surface of the tumor which convey the blood from the tumor to the venous channels shown in Fig. 14. These veins are sometimes injured or become eroded and intraperitoneal hemorrhage occurs, as has been reported in the literature.

the study of the injected specimens, muscular inefficiency seems to me to be the most important factor, as it would fail to prevent the reflux of blood from the plexus of the myometrium into that of the endometrium and would fail to occlude the uterine cavity.



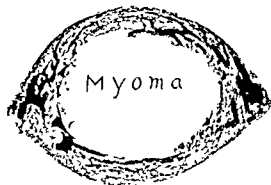


Fig. 17 Dilatation of venous plexus of the myometrium about an intramural myoma. Slightly reduced in size. Radiograph of a cross slice 3 mm thick through the fundus of the uterus and myoma above the uterine cavity. Veins injected with bismuth, para, aged 28. There is a marked dilatation of the venous plexus of the myometrium.



Fig. 18 Dilatation of venous plexus of myometrium and endometrium. Same specimen shown in the preceding illustration (menorrhagia). Radiograph of a cross slice, 3 mm thick, through the body of the uterus below the tumor. Uterus removed in the interval stage of the menstrual cycle. There is a general venous active hyperemia, with dilatation of the venous plexuses of the myometrium and endometrium, apparently caused by the myoma. The hypertrophied endometrium may be caused by this hyperemia. Menstruation had become much more profuse for four months prior to operation, i. e., the uterus was unable to control this hyperemia, and an excessive amount of venous blood escaped during the menstrual flow.

#### MEDIUM SIZE AND LARGE INTRAMURAL MYOMATA

##### *Changes Caused by Them in the Circulation of the Uterus*

Medium size and large intramural myomata were found in 76 specimens, in 60 of these they were the principal variety present, while in 16 a more important variety or condition was associated with them, as submucous myomata in 11, adenomyoma in 3, sarcoma in 1, and carcinoma of the cervix in another. Sixty of these specimens were used in the study of this phase of the subject. In 3 only one tumor was found, while in 57 multiple intramural myomata were present.

These specimens have been arranged in three groups.

- 1 Those not encroaching upon the uterine cavity
- 2 Where a single tumor encroaches upon the uterine cavity
- 3 Where multiple tumors encroach upon the uterine cavity

*Medium size and large intramural myomata not encroaching upon the uterine cavity*—These were found in many of the specimens, but only in 6 were they the principal condition present, and in all 6 other smaller tumors were present. They develop in the peripheral zone of the uterus, and are nourished by peripheral arteries which supply the tumor

as the smaller tumors are nourished. There is usually one principal nutrient artery, and secondary ones may be present which communicate with branches of the principal one; in addition there is sometimes found a communication between arterioles in the periphery of the tumor and those in the surrounding myometrium, as has been described in the previous article. The venous supply of these tumors is usually scanty, and in some apparently lacking. Tumors of this size contain a larger number of arteries than the surrounding myometrium and sometimes are so vascular that they appear as an arterial angioma rather than a myoma (Fig. 14).

A study of the injected specimens shows that these tumors contain many tortuous vessels filled with arterial blood and that the veins within the tumor are usually scanty (Fig. 15), this suggests that the circulation of the tumors is very sluggish. Nevertheless, there is a demand for more blood to be carried to and away from the uterus, and therefore the extrinsic uterine arteries and veins are usually increased in size. One uterine artery is sometimes larger than the other, namely, the one nourishing the largest myoma or the greatest number. The arcuate artery from



Fig. 19 Large radial intramural myoma, changes in the arterial circulation of the uterus. X 1. Radiograph of a sagittal slice, 5 mm. thick, of the body of the uterus and portion of the myoma. Para, aged 49, arteries injected with bismuth. The tumor, 10 cm. in diameter arose in the radial zone of the posterior uterine wall and caused a symmetrical enlargement of the uterus. The uterine arteries, not shown in this slice were enlarged and more blood was carried to the uterus and tumor, but the excess over the normal was carried to the tumor through its nutrient arteries. In addition there is a communication between arterioles in the periphery of the tumor and those in the surrounding myometrium. The tumor apparently has had very little influence on the arterial supply of the uterus, except that the radial arteries supplying the endometrium nearest the tumor have to curve around the tumor to reach it. The diminution of the arterial supply of the uterine tissues is possibly due to the age of the patient — 49 years.

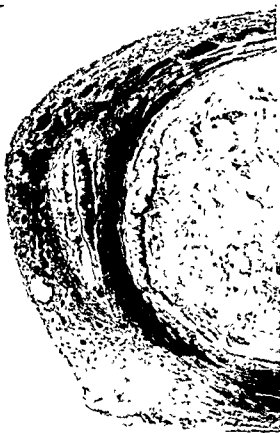


Fig. 20 Influence of the myoma shown in the preceding illustration on the venous circulation of the uterus (menstruation normal and moderate). Photograph of the surface of the slice shown in the preceding illustration, veins injected with ultramarine blue, uterus removed during the interval stage of menstrual cycle. The myoma has caused an enlargement of the uterus, i. e. a hypertrophy of the walls and dilatation of the venous plexus, especially about the periphery of the tumor and between it and the endometrium. The latter is hypertrophied, and the portion nearest the tumor is thicker and more vascular (venous) than the rest of the endometrium. In spite of the hypertrophy and increased vascularity of this portion of the endometrium (venous congestion), and the dilated venous plexus between it and the myoma, menstruation had always been normal and moderate in amount. The uterus was able to control this venous congestion and prevent an excessive flow of venous blood at the menstrual period.

which the principal nutrient artery arises is also increased in size. As in large subserous myomata, the excess arterial supply of the uterus as a whole is diverted to the tumor or tumors. The tumor mechanically causes a displacement of the arteries in the surrounding myometrium. The myometrial venous

plexus about the tumor is always dilated. As the latter condition exists about the entire circumference of the tumor, it is principally one of active and not passive venous hyperæmia. A study of the six cases shows that the disturbance in circulation is chiefly a local one, and in four of the six specimens it

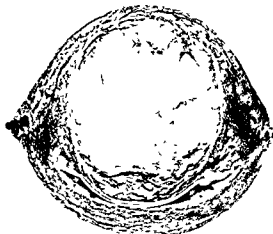


Fig. 26 Large radial intramural myoma menstruating endometrium (menorrhagia) X 34. Radiograph of a cross slice of the uterus. Nullipara, aged 35, veins injected with bi-muth, uterus removed the first day of the menstrual flow. The endometrium over the tumor is anæmic and atrophied while that lateral to the tumor and not compressed by it is hypertrophied, the uterine cavity opposite the latter (X and X) is filled with the injection mass (black) which escaped from the superficial portion of the venous plexus of the hypertrophied endometrium. The venous plexus of the myometrium is dilated. Menstruation was profuse and prolonged, i. e. the uterus was unable to control its increased vascularity and prevent an excessive flow of venous blood into the uterine cavity during the menstrual flow.



Fig. 28 Two large radial intramural myomata, menstruating endometrium (menstruation slightly increased in amount). Slightly reduced in size. Photograph of a cross section of the uterus and myomata. Nullipara aged 32, arteries injected with ultramarine blue and veins with bi-muth, uterus removed the first day of the menstrual flow. A large myoma is situated in the radial zone of each uterine wall. The myomata have a very rich arterial blood supply (black). The venous plexus of the myometrium (white) is dilated especially about the myomata. The endometrium (half way between the myomata) is hypertrophied (its blood supply is not interfered with) and there is an extravasation of the venous injection mass (white) into its tissues. Menstruation had recently become slightly more profuse and prolonged, i. e. the uterus was beginning to be unable to prevent an excessive flow of venous blood into the uterine cavity during the menstrual flow.

a zone of myometrium. We find in the radiographs that the radial arteries curve around the tumor, and while distorted in their course are still able to reach the endometrium lining the cavity nearest the tumor. The venous plexus of the myometrium between the endometrium and tumor is usually dilated. The uterine cavity is usually broadened or lengthened, or both. The endometrium nearest the tumor is sometimes thickened and other times thinned. The latter condition may be due to pressure or interference with its blood supply. Conditions found in some of the injected specimens would seem to support the theory advanced

by Clark,<sup>1</sup> viz. that such tumors mechanically compress the veins more readily than the arteries, and therefore cause a local conges-

<sup>1</sup> Johns Hopkins Bull. 1890, x, 11, 20.

Fig. 27 (See front-piece) Two large radial intramural myomata approaching the uterine cavity (menstruation moderate) X 1. Colored photograph of a median sagittal section of the uterus and myomata. Nullipara, aged 37, arteries injected with Venetian red and veins with ultramarine blue, uterus removed in the interval stage of the menstrual cycle. A large myoma is situated in the radial zone of each uterine wall, the venous plexus of the myometrium is dilated, especially about the periphery of the tumors, between them and the uterine cavity. The endometrium is hypertrophied and injected (venous). Menstruation was normal and moderate in amount, i. e. the uterus was able to control its "venous congestion" and prevent an excessive flow at the menstrual period.

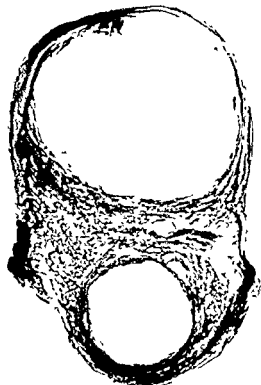


Fig. 20. Same specimen shown in preceding illustration. Radiograph of a cross slice 7 mm thick of the uterus and myomata, photograph of the surface shown in preceding illustration, veins injected with bismuth. This shows the scarcity of veins in the myomata (compare with its arterial supply shown in preceding illustration) and the great dilatation of the venous plexus of the myometrium about the tumors. There is an extravasation of the injection mass into the tissues of the endometrium.

tion of the portion of the endometrium over the tumor, and hence menorrhagia results but the history of these cases do not entirely support this view. While menorrhagia occurs in some of them, menstruation in others is normal (Fig. 20), and menorrhagia is much less apt to occur in this group than in the one about to be described, where the portion of the tumor encroaching upon the uterine cavity is covered only by the endometrium, and that portion of the endometrium is anemic. While the local congestion, when it is present may be a contributory factor in making the menstrual flow more profuse, it is not the chief one, and we are forced to explain the bleeding when it occurs in this group as being due mainly to a condi-



Fig. 20. From same specimen shown in the two preceding illustrations. Radiograph of the upper slice of the specimen showing the dilated venous channels of the myometrium spread over the upper surface of each tumor.

tion of uterine inefficiency. The uterus is unable to control the great venous hyperæmia which exists and prevent an excessive flow of venous blood at that time. We find identical anatomical conditions in two specimens, i. e., great venous hyperæmia of both myometrium and endometrium, and especially marked between the tumor and the uterine cavity, yet in one the menstruation is unaltered and in the other menorrhagia or metrorrhagia exists. In 8 specimens where the tumor was separated from the endometrium by a zone of myometrium, only three gave a history of menorrhagia.

The next group, where the tumor encroaches more upon the uterine cavity, represents a later stage of the preceding one and included 36 specimens. In this group the myoma is separated from the uterine cavity by a thin capsule of myometrium or the endometrium alone. I have included in this group all

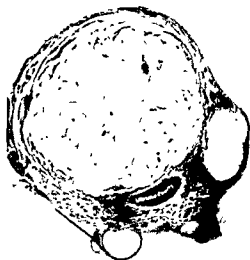


Fig. 21. The influence of a medium size radial intramural myoma on the arterial supply of the endometrium over it. Slightly reduced in size. Radiograph of a cross slice 4 mm. thick of the fundus of the uterus and myoma. Parv aged 40. Arteries injected with red lead. The myoma 1 cm. in diameter, is situated in the radial zone of one cornu and encroaches upon the uterine cavity. The myoma pushes to one side the radial arteries about it and thus interferes with the arterial supply of the endometrium over it. The more it encroaches upon the uterine cavity the greater this interference and therefore the more anastom. the endometrium over it.

Fig. 23. Large radial intramural myoma, menorrhagic endometrium (menorrhagia). N. J. Photograph of a cross section of the uterus. Nullipara, aged 34, arteries injected with Venetian red and veins with ultramarine blue, uterus removed the second day of the menstrual flow. The largest myoma 8 cm. in diameter, is situated in the radial zone of the posterior uterine wall and is beginning to encroach upon the uterine cavity. The arterial injection mass did not escape into the uterine cavity, but the venous mass did. The cervix was clamped prior to the injection of the venous mass, therefore the uterine cavity is distended with this mass. For further details see next illustration.

was confined mainly to the peripheral zone of the uterus and the circulation of the radial zone and endometrium was unaltered. The uteri apart from the tumors were only slightly increased in size. We would expect that in these four cases menstruation would not be affected by the tumor or tumors, and it was not. In two patients menstruation had apparently been altered by the myomata. In one it had become more profuse, many medium size intramural myomata were present in the peripheral zone of the uterus and these may have mechanically embarrassed the flow of blood from the radial zone, the uterus as a whole was increased in size. Here again muscular inefficiency may have been at fault, i. e., more blood in the radial zone than the musculature of the uterus could handle. The other patient had both menorrhagia and metrorrhagia, and the specimen

apart from the myoma was typical of *myofibrosis uteri*.

*Single medium size or large intramural (radial) myomata which encroach upon the uterine cavity.* These were found in 44 specimens as the principal condition present. They were also found in other specimens but were overshadowed by some other condition, as a submucous myoma, sarcoma, carcinoma, etc. In three of the 44 specimens only one, myoma was present. In the remaining 41, other but less important myomata were found.

These tumors had all developed in the radial

Fig. 22. (See frontispiece.) Large radial intramural myoma encroaching upon the uterine cavity (menorrhagia). N. J. Colored photograph of a lateral sagittal section of the uterus and myoma. Nullipara aged 40, arteries injected with Venetian red and veins with ultramarine blue, uterus removed in the interval stage of the menstrual cycle. The myoma is situated in the radial zone of the posterior uterine wall, and has caused a symmetrical enlargement of the body of the uterus. The uterine walls are hypertrophied and their venous plexus dilated. The tumor encroaches upon the uterine cavity, and the endometrium over it and opposite it is anemic. On the other hand the endometrium not encroached upon, either directly or indirectly is hypertrophied, it is from the latter portion of the endometrium that the menstrual flow for the most part arises. Menstruation was very profuse and prolonged, i. e., the uterus was unable, in this case, to control its increased vascularity and prevent an excessive flow of venous blood into the uterine cavity. The venous injection mass did not escape into the uterine cavity because the patient was not flowing at the time of the operation.



Fig 24 Menstruating endometrium X 4 From photograph shown in preceding illustration Enlargement X 4 of a portion of the uterine cavity and surrounding tissues The cavity is distended with the venous injection mass, cervix clamped A hematoma is present at X and the overlying endometrium has ruptured, permitting the escape of the venous injection mass into the uterine cavity The glands of the endometrium are easily discernible

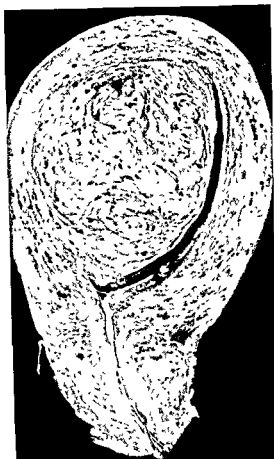


Fig 25 Radial intramural myoma menstruating endometrium (menorrhagia) X 1 Photograph of a median sagittal section of the uterus Para, aged 41, arteries injected with ultramarine blue and veins with bismuth, uterus removed the first day of the menstrual flow The myoma, 5 cm in diameter, is situated in the radial zone of the posterior uterine wall and encroaches upon the uterine cavity The endometrium over the tumor and directly opposite it is atrophied and anæmic The endometrium not encroached upon is vascular, and the menstrual flow arises from this, as shown by the extravasation of the bismuth (white) into the tissues of the endometrium and thence into the uterine cavity Menstruation was very profuse and prolonged, 1 e., the uterus was unable to prevent an excessive flow of venous blood in the uterine cavity

zone and were all nourished by radial arteries Their blood supply and circulation are similar to those developing in the peripheral zone They are intrauterine growths in the true sense of the term The body of the uterus as a whole is hypertrophied The degree of uterine hypertrophy apparently varies greatly in different specimens and seems more marked in the relatively young women In those at or past the menopause it is apparently not as evident The increased thickness of the wall is due principally to two conditions first, an actual hypertrophy of its tissues, and secondly a dilatation of the venous plexus of the entire myometrium, most marked where the pressure is least The arterial supply of the entire uterus is increased, and much of the excess over the normal is diverted to the tumor or tumors The uterine veins are also enlarged The tumors cause a local displacement of the arteries in the surrounding myometrium, and the venous plexus of the myometrium immediately about the tumor is often dilated As these tumors approach the uterine cavity they alter its

size and shape and usually make it larger, but may occasionally make it smaller, as when a moderate size tumor develops in the fundus or lateral wall of the uterus.

Let us first consider uteri containing tumors which, while encroaching upon the uterine cavity, are still separated from it by

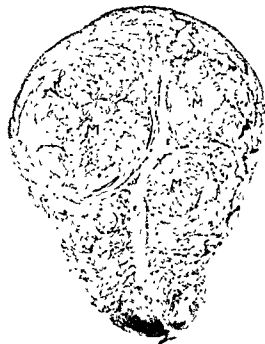


Fig. 31. Multiple radial intramural myomata encroaching upon the uterine cavity; arterial supply of endometrium (menstruation recently more profuse).  $\times \frac{1}{2}$ . Radiograph of a mesh in sagittal slice, 4 mm. thick, of the uterus. Para aged 43, arteries injected with red lead. The myomata M, M, M encroach upon the uterine cavity and the endometrium over them is atrophied and anæmic; the myomata push to one side and intercept the radial arteries supplying this portion of the endometrium. At F, E, E, the radial arteries are able to reach the endometrium, there is no pressure, and the endometrium is hypertrophied. Menstruation was beginning to become more profuse, i. e., the uterus was beginning to lose control of its increased vascularity.



Fig. 32. Arterial supply of hypertrophied endometrium, not encroached upon by myomata. Same specimen as the preceding.  $\times \frac{1}{2}$ . Radiograph of a lateral sagittal slice, 4 mm. thick taken lateral to the myomata shown in the preceding illustration. The endometrium is hypertrophied, its arterial supply is not only not interfered with but is apparently increased in amount.

those in which less than one half the circumference of the tumor projected into the cavity. When more than this occurred they were included with the submucous tumors. The vascular changes in the myometrium are the same as in the preceding group, except for the thin zone which is sometimes present between the tumor and the endometrium. This zone in the preceding group was richly supplied with venous blood, while in the present group it is usually anæmic. The endometrium over the tumor is also thin and anæmic. The radiographs of specimens when the arteries are injected with bismuth show that the tumor mechanically interferes with

the arterial supply of this portion of the endometrium (Fig. 21). The radiographs of specimens where the veins are injected show that this portion of the endometrium is also poorly supplied with veins (Fig. 22, see frontispiece), the rich venous plexus of the endometrium having disappeared and being replaced by a fine network of veins. Here and there a large vein may be present, just as we find large veins extending over the surface of a subserous tumor. Histologically<sup>1</sup> the glands are few in number, atrophied or entirely lacking. In extreme cases the endometrium covering the tumor is similar in its vascularity to the peritoneum covering the subserous variety.

The vascularity of the endometrium of the uterine wall opposite the tumor varies according to the size of the tumor and changes in form of the uterine cavity. When the tumor

<sup>1</sup> Beautifully shown in the illustrations in Kelly and Cullen's book *Myomata of the Uterus*, W. B. Saunders & Co. 1909.



Fig 33 Multiple radial intramural myomata encroaching upon the uterine cavity (menorrhagia)  $\times \frac{3}{5}$  Radiograph of a cross slice, 4 mm thick, of the uterus and myomata Nullipara, aged 27, veins injected with bismuth, uterus removed in interval stage of menstrual cycle Nine radial intramural myomata appear in this section The plexus of the myometrium is dilated the uterine cavity is distorted, and the endometrium in places hypertrophied Menstruation was prolonged and profuse, i e., the uterus was unable to prevent an excessive flow of venous blood into the uterine cavity at the menstrual period

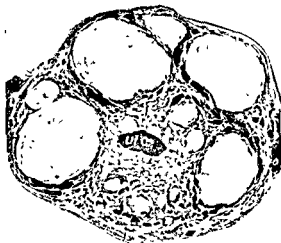


Fig 34 Multiple radial intramural myomata (slight menorrhagia)  $\times \frac{3}{5}$  Photograph of a cross section of the uterus Nullipara, aged 46, veins injected with ultramarine blue and arteries with Venetian red, uterus removed at the menopause Slight irregular bleeding was present at the time of the operation Cervix clamped before injecting the venous mass, and the uterine cavity is distended with this mass, i e., the bleeding was venous The marked dilatation of the venous plexus of the myometrium, especially about the large myomata, is shown Many small myomata are situated in the radial zone about the uterine cavity The endometrium everywhere was atrophic (menopause) The last regular menstrual flow occurred six months before the operation, menstruation had been moderate in amount, but the patient had had irregular "spotting" since the menopause The injection mass escaped from the atrophied endometrium, i e. the uterus was unable to control its venous circulation

is small, the opposite wall and its vascularity are very little changed In large tumors, with a corresponding increase in size of the uterine cavity, the uterine wall opposite the tumor is thinned, the course of the radial arteries in this portion of the wall are more oblique than normal, and they are also separated further from each other. The venous plexus of the myometrium where pressure is greatest is compressed The endometrium covering this portion of the uterine wall is often thinner than usual and anæmic The thinning of this portion of the endometrium, I believe, is due not only to mechanical pressure and a pulling out of the uterine wall, but also to an interception of its blood supply.

Now let us consider the portions of the endometrium not encroached upon by the tumor. The situation of these portions varies

with the situation and size of the tumor. Take as an example a tumor 5 cm in diameter situated in the center of the posterior wall of the uterus We find that the endometrium is thickest above and below the tumor and at the sides The arterial supply of these portions is not interfered with, and the venous plexus is usually greatly hypertrophied. The blood supply of the endometrium covering these portions of the myometrium is not only not diminished but often apparently is increased; the radial arteries supplying it are sometimes apparently larger and even more numerous. The endometrium is always thicker than elsewhere in the specimen. In the majority of the cases it is thicker than normal, and sometimes there is marked hypertrophy. It was found hypertrophied in 24 of the 36 specimens. In the remaining



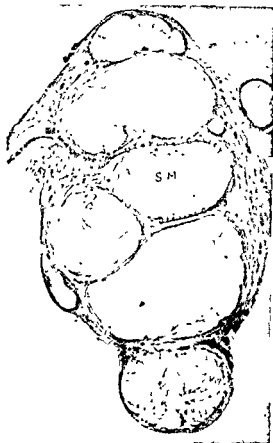


Fig. 35 Submucous myoma, and multiple intramural and subserous myomata (menorrhagia). X  $\frac{1}{2}$ . Photograph of sagittal section of the uterus, arteries injected with Venetian red and veins with ultramarine blue. Nullipara, aged 46, uterus removed during the interval stage of the menstrual cycle, menstruation profuse and prolonged. The submucous myoma (S M) projects into the uterine cavity for over half its circumference. The endometrium over it and opposite it is anemic and atrophied. The endometrium not encroached upon by the tumors directly or indirectly is hypertrophied.

12 it was thicker than elsewhere in the specimen, but not actually hypertrophied. Three of these 12 were past the menopause; and the phase of the menstrual cycle when the uterus was removed, and the fact that some of them were operated upon soon after a prolonged flow, may account for the thinness of the entire endometrium in these specimens. The venous plexus of these portions of the endometrium is usually also hypertrophied, and the venous channels uniting the plexus of the



Fig. 36 Hypertrophied endometrium lining uterine cavity not encroached upon by myomata. X 4. Enlargement X 4, of a portion of the hypertrophied endometrium shown in the preceding illustration. The endometrium is greatly thickened, glands are very abundant, i. e., the tortuous white streaks, and the tissues are well supplied with venous blood. The endometrium covering the tumors is atrophied, anemic, and devoid of glands. It is from the former portion of the endometrium that the menstrual flow arises and in this instance was very profuse.

endometrium with that of the myometrium are often larger than normal. The hypertrophy of the endometrium is due not only to its apparent increased arterial supply and venous congestion, but I believe it is also due to the fact that there is not only room for it to grow, but there is a necessity for it to fill in the spaces (depressions) caused by the irregularities in the uterine cavity. This endometrium is rich in glands.

From a histological study of the injected specimens we would suppose that when menstruation occurs it would take place, not from the endometrium over the tumor, which is lacking in glands and a venous plexus so necessary for the flow, but from the endometrium not encroached upon by the tumor, which not only contains glands and a plexus,



Fig. 37 Submucous myoma, arterial circulation of the uterine tissues, especially the endometrium (menstruation recently slightly more profuse). Slightly reduced in size. Radiograph of a cross slice, 3 mm thick, of the uterus and submucous myoma. Nullipara aged 39, arteries injected with bismuth. A submucous myoma arose in the fundus and protruded into the uterine cavity. Several small intramural myomata were also present. The submucous myoma was very vascular and the arterial supply of the uterus and tumor increased. The endometrium anterior and posterior to the tumor is atrophied by pressure while lateral to it, where pressure is not exerted, it is hypertrophied as though it filled in the gaping uterine cavity. Menstruation had been very little altered by the submucous myoma although the patient thought it had recently been slightly more profuse and occasionally a slight spotting was present in the intervals. Uterus removed for chronic pelvic peritonitis.

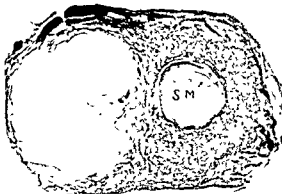


Fig. 38 Submucous and intramural myomata, venous circulation of the uterus (menorrhagia). X 34. Radiograph of a cross slice 3 mm thick, of the uterus and two myomata. Para aged 39, veins injected with bismuth, uterus removed at onset of menstrual flow. The uterine cavity is distended with the submucous myoma (S M). Dilated veins are present over the surface of the myoma as in subserous myomata, but the bleeding did not arise from these in this instance. See next illustration.

but both often hypertrophied, thus suggesting increased functional activity. This plexus also communicates with a dilated myometrial plexus containing more blood than normal and united with it by larger channels. I have studied 3 specimens which were removed and injected the first day of menstruation (Figs. 23, 24, 25 and 26). In all these the portion of the atrophied endometrium over the tumor apparently did not take part in menstruation, and the most active flow occurred from the places above described. I have studied other specimens removed from patients who were flowing irregularly at the time of the operation and found the same to be true. Unless the patient is actually flowing, or is about to flow or has just ceased flowing, the injection mass will not escape into the uterine cavity. Changes in the venous plexus of the endometrium are essential for the flow, and these changes are usually initiated, in this group of cases, by the onset of

menstruation, though the bleeding may continue for many days or even weeks afterwards. From a study of the injected specimens alone we would assume that the prolonged profuse menstruation so often seen in these cases was due to the hypertrophy of the endometrium, with its increased venous plexus which, through larger channels than normal communicated with a hypertrophied venous plexus of the myometrium. The clinical study of these cases showed that 6 of the 36 cases gave a history of normal menstruation, while in 30, menorrhagia or metrorrhagia was present. We must also bear in mind that uterine bleeding is the symptom which usually induces these patients to consult a physician and also influence the physician to advise an operation. Therefore, a greater proportion of those with bleeding are operated upon than those who are not bleeding, and the ratio of 30 to 6 does not represent the true ratio. When we study the specimens in these two groups, i. e., those with and without bleeding, we find the same anatomical conditions present in both groups. In fact, some of the patients with the thinnest endometrium had the most profuse bleeding. As stated before, the thickness of the endometrium varies with the individual, her age,

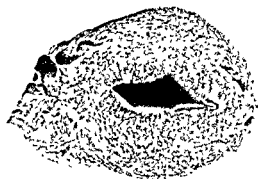


Fig. 39 Menstruating endometrium from same specimen as preceding. X 1. Radiograph of a cross slice, 3 mm thick, of the body of the uterus near the fundus, and above the two myomata shown in the preceding illustration. The uterine cavity is filled with the venous injection mass, which escaped from the superficial portion of the venous plexus of the endometrium not encroached upon by the myomata, and here the endometrium is slightly hypertrophied. The uterus was unable to control its venous circulation.

and the period of the menstrual cycle when the uterus was removed — thickest just before menstruation, thinnest just after, and especially after a profuse flow.

Some of these cases do not bleed, and this is apparently because the uterus is able to control the flow, even though the uterus as a whole contains more blood and has to work under disadvantages, i. e., portions of the endometrium are hypertrophied, the venous plexuses of those portions and that of the myometrium are dilated, and the venous channels uniting the two are larger than normal, and the uterine cavity on account of its shape is difficult to close. On the other hand, many of these cases have menorrhagia or metrorrhagia, and this is due to the inability of the uterus to regulate the flow, which is due to many factors, and I believe chief among these are functional ones, especially muscular inefficiency.

The factors which might increase the flow are

1. Increased ovarian activity, which can not be detected anatomically, though the ovaries are sometimes enlarged. The myomatous uterus may stimulate the ovaries chemically and also through the increased vascularity of the uterine circulation.



Fig. 40 Submucous myoma presenting at the external os (slight irregular bleeding). X 1. Photograph of a sagittal section of the uterus exposing the submucous myoma. Para, aged 51, veins injected with ultramarine blue and arteries with bismuth. The uterus also contained several small intramural myomata. The venous injection mass escaped from the superficial veins over the surface of the myoma, at X, X, X, which had become eroded. The patient gave a history of menorrhagia three years before, which gradually lessened and lately there was slight irregular bleeding.

2. More arterial and venous blood for the uterus to handle and the possibilities of venous congestion, due to the greater volume of venous blood in the uterus and in the uterine and ovarian veins and because the tumors themselves sometimes mechanically interfere with the return flow of blood.

3. Localized hypertrophy of the endometrium, where it is not directly or indirectly encroached upon by the tumor. This hypertrophy carries with it the possibility of increased functional activity, and I refer especially to glandular activity and the production of a ferment which would not only

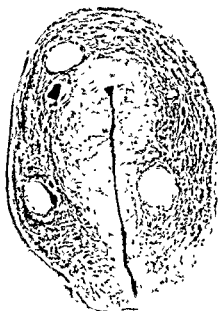


Fig 41. Adenomyoma and small intramural myomata (menorrhagia). X 1. Photograph of median sagittal section of the uterus. Para, aged 48, arteries injected with Venetian red and veins with ultramarine blue, uterus removed during the interval stage of the menstrual cycle for bilateral ovarian cysts. Three small intramural myomata appear in this section, the entire uterine cavity including each cornu, is surrounded by a diffuse adenomyoma. The endometrium was everywhere atrophic. The patient gave a history of very profuse and prolonged (abnormal) menstruation of four years' duration. Adenomyomata may sometimes cause menorrhagia.

alter the venous plexus of the endometrium at the onset of menstruation but which might retard its subsequent repair.

4. Dilatation of the venous plexus of the localized hypertrophied portion of the endometrium, and that of the myometrium into which it empties and the venous channels between the two, making the control of the "protective" zone between the two more difficult.

5. Dilated veins sometimes present in the endometrium over the tumor, which may through pressure become eroded or may be acted upon by the products of the glands at the time of menstruation. (I have occasionally seen slight extravasation of the injection mass into the endometrium over the tumor, and can see how that bleeding may arise from this situation, but have never found any other proof of this.)

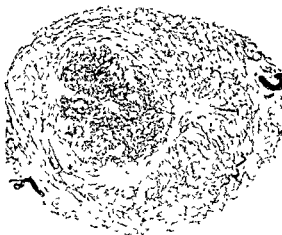


Fig 42. Adenomyoma, and radial intramural myoma encroaching upon the uterine cavity. Arterial injection. (Menstruation, normal.) Slightly reduced in size. Radiograph of a cross slice 4 mm thick, of the body of the uterus near the fundus. Para, aged 48, arteries injected with bismuth, uterus removed during the interval stage of menstrual cycle for chronic pelvic peritonitis. The intramural myoma is very vascular and the diffuse adenomyoma surrounding the greater part of the uterine cavity not encroached upon by the intramural myoma is more vascular than normal. The uterine cavity is distorted. The endometrium is not hypertrophied in any part. Adenomyomata as other varieties of myomata, do not necessarily cause menorrhagia.

6. In an irregular uterine cavity which is difficult to close.

Any one of the above mentioned factors might prolong or make more profuse the menstrual flow, and yet all these conditions are sometimes apparently present in patients in whom menstruation is unaltered. I believe that while all of the above factors contribute to disturbances in menstruation, we are forced to admit that the failure of the uterus to control the menstrual flow in these cases is in a large measure functional. This functional disturbance might be ovarian, in the endometrium, or in the myometrium, and my studies have led me to support Theilhaber's views that muscular inefficiency is the most important single cause of the abnormal bleeding. Theilhaber has shown that the muscular fibres of the myomatous uterus are smaller in patients with a history of bleeding than in others.

The type of bleeding caused by intramural myomata encroaching upon the uterine cavity



Fig 43 Adenomyoma and large intramural myoma. (Menstruation, moderate, normal)  $\times 4$ . Photograph of median sagittal section of the uterus and portion of large intramural myoma. Para, aged 49, arteries injected with Venetian red and veins with ultramarine blue, uterus removed in post menstrual stage of menstrual cycle. A large intramural myoma, 14.5 cm in its long diameter, is present in the posterior uterine wall, only a part of it appears in the illustration. The myoma in the anterior uterine wall is an adenomyoma and there is beginning adenomyoma about the upper portion of the uterine cavity. The venous plexus of the myometrium is dilated. The endometrium is hypertrophied except over the adenomyoma. Some of the venous injection mass escaped into the cavity. Uterus removed just after the menstrual flow. In spite of the increased vascularity of the uterus and the presence of a large intramural myoma and adenomyoma, menstruation was moderate in amount and normal, i. e., the uterus was able to control its venous circulation.

is a profuse or prolonged menstruation, or both profuse and prolonged. Sometimes intermenstrual bleeding occurs, and I think that it is but a further index of broken compensation. I have not had the opportunity to study a sloughing myoma, but would expect that when such a specimen was injected the injection mass would escape from the tumor and hence would be arterial rather than venous, as occurred in all the specimens studied in this series who were flowing at the time of the operation and where the injection mass escaped from the endometrium.

*Multiple medium size and large intramural myomata encroaching upon the uterine cavity*—This group should be a subdivision of the

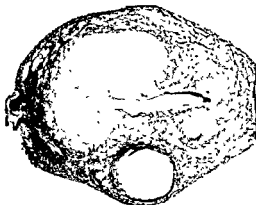


Fig 44 Adenomyoma and small intramural myoma venous injection (severe menorrhagia)  $\times 2\frac{1}{2}$ . Radiograph of a cross slice, 5 mm thick, through the fundus of the uterus. Para, aged 49, veins injected with bi-smuth, uterus was bleeding slightly when removed. An adenomyoma (apparently developing in each cornu) surrounded the greater portion of the uterine cavity, a small intramural myoma is present in the anterior wall. The venous plexus of the myometrium is dilated. The endometrium is everywhere atrophic. Some of the venous injection mass escaped into the uterine cavity, which gapes open. The patient gave a history of severe menorrhagia, varying in amount and duration and often lasting several weeks. Last flow ceased seven weeks before the operation and patient had just started to flow again. The uterus was unable to control its venous circulation.

preceding one. The changes are similar to the preceding one. The areas of hypertrophied endometrium are found in the crevices between the tumors and wherever the nutrition of the endometrium is not interfered with by the tumors intercepting it or from pressure (Figs 31 and 32). The uterine cavity is often greatly distorted and therefore more difficult to be kept enclosed (Fig 33). Ten such specimens were found. Two gave a history of normal menstruation, 7 of menorrhagia, and 1 of metrorrhagia. In 9, areas of hypertrophied endometrium were found, and in 1 (the one with metrorrhagia) the endometrium was everywhere atrophied (the patient's age was 50).

#### SUBMUCOUS MYOMATA

##### *Changes Caused by Them in the Circulation of the Uterus*

Sixteen specimens were obtained where a submucous myoma was the principal condition present. In addition, 3 of the 12 speci-



Fig. 45 Adenomyoma venous injection menstruation normal, always profuse. X 1. Radiograph of a cross slice, 5 mm thick, through the body of the uterus. Para aged 43 veins injected with bismuth uterus removed for chronic pelvic peritonitis in the post menstrual stage of the menstrual cycle. An adenomyoma (apparently developing in each cornu) surrounded the upper portion of the uterine cavity. Small intramural myomata were also present. The venous plexus of the myometrium is dilated. The endometrium is not hypertrophied. The uterus was able to control its venous circulation.

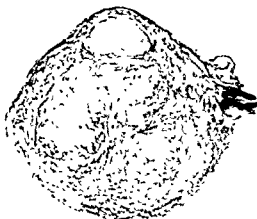


Fig. 46 Adenomyoma, almost occluding the uterine cavity. Small intramural myoma venous injection. Menstruation normal profuse. X 1. Nullipara aged 28. The uterus was removed for chronic pelvic peritonitis. The uterine cavity is very small, being almost occluded by the adenomyoma surrounding it. Otherwise the legend of Fig. 45 will apply to this.

mens with adenomyomata also had submucous myomata. I have included as submucous myomata all myomata protruding into the uterine cavity for half or more of their circumference. They represent a later stage of the preceding variety. Of these 16 specimens more than one submucous myoma was found in 5, and in all intramural myomata of various sizes were found.

The changes caused by the sessile submucous myomata are similar to those found in the intramural tumors already considered. Pedunculated submucous myomata were found in 8 specimens and one of these presented at the external os. The endometrial surface of the pedunculated myomata simulates very closely the serous surface of the pedunculated subserous variety. The endometrial surface is devoid of true endometrium, and the endometrium covering the uterine cavity in contact with the tumor is usually compressed while the endometrium lining the cavity and not in contact with the tumor is always comparatively thicker and often hypertrophied. We would suppose that menstruation would occur mainly from that portion of the endometrium containing glands and having a good blood supply and not compressed by the tumor, and such is the case (Figs. 38 and 39). The menstrual history

of these cases showed that all but one gave a history of menorrhagia or metrorrhagia as in the menstrual history of intramural variety with menorrhagia, and it was not a constant symptom, i. e. it did not occur with every menstruation.

As stated these tumors do not necessarily cause bleeding, but apparently cause it in a larger percentage of the cases than the preceding. They represent a later stage of the disease. They are more apt to have metrorrhagia which is also a manifestation of a later stage of the disease. The metrorrhagia in some of these cases may come from rupture of the veins over the surface of the tumor. I was able to demonstrate this in one of my specimens (Fig. 46). We know that intraperitoneal hemorrhage may occur from the rupture of dilated veins over a subserous myoma. In a pedunculated submucous tumor the return of the venous blood is often interfered with and the surface of the tumor is exposed to trauma and irritation.

#### ADENOMYOMATA

##### *Changes Caused by Them in the Circulation of the Uterus*

This variety of myoma was found in twelve specimens, and in each specimen other varieties of myomata were also present. In four,



Fig. 43 Adenomyoma and large intramural myoma. (Menstruation moderate normal) X 1. Photograph of median sagittal section of the uterus and portion of large intramural myoma. Para, aged 40, arteries injected with Venetran red and veins with ultramarine blue, uterus removed in post-menstrual stage of menstrual cycle. A large intramural myoma, 14.5 cm. in its long diameter is present in the posterior uterine wall, only a part of it appears in the illustration. The myoma in the anterior uterine wall is an adenomyoma, and there is beginning adenomyoma about the upper portion of the uterine cavity. The venous plexus of the myometrium is dilated. The endometrium is hypertrophied except over the adenomyoma. Some of the venous injection mass escaped into the cavity. Uterus removed just after the menstrual flow. In spite of the increased vascularity of the uterus and the presence of a large intramural myoma and adenomyoma, menstruation was moderate in amount and normal, i. e. the uterus was able to control its venous circulation.

is a profuse or prolonged menstruation, or both profuse and prolonged. Sometimes intermenstrual bleeding occurs, and I think that it is but a further index of broken compensation. I have not had the opportunity to study a sloughing myoma, but would expect that when such a specimen was injected the injection mass would escape from the tumor and hence would be arterial rather than venous, as occurred in all the specimens studied in this series who were slowing at the time of the operation and where the injection mass escaped from the endometrium.

Multiple medium size and large intramural myomata encroaching upon the uterine cavity—This group should be a subdivision of the

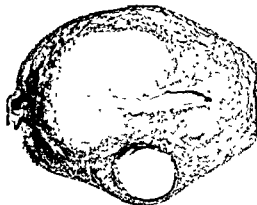


Fig. 44 Adenomyoma and small intramural myoma venous injection (severe menorrhagia) X 2. Radiograph of a cross slice, 5 mm. thick, through the fundus of the uterus. Para, aged 40, veins injected with bi-muth, uterus was bleeding slightly when removed. An adenomyoma (apparently developing in each cornu) surrounded the greater portion of the uterine cavity, a small intramural myoma is present in the anterior wall. The venous plexus of the myometrium is dilated. The endometrium is everywhere atrophic. Some of the venous injection mass escaped into the uterine cavity, which gapes open. The patient gave a history of severe menorrhagia varying in amount and duration and often lasting several weeks. Last flow ceased seven weeks before the operation and patient had just started to flow again. The uterus was unable to control its venous circulation.

preceding one. The changes are similar to the preceding one. The areas of hypertrophied endometrium are found in the crevices between the tumors and wherever the nutrition of the endometrium is not interfered with by the tumors intercepting it or from pressure (Figs. 31 and 32). The uterine cavity is often greatly distorted and therefore more difficult to be kept enclosed (Fig. 33). Ten such specimens were found. Two gave a history of normal menstruation, 7 of menorrhagia, and 1 of metrorrhagia. In 9, areas of hypertrophied endometrium were found, and in 1 (the one with metrorrhagia) the endometrium was everywhere atrophied (the patient's age was 50).

#### SUBMUCOUS MYOMATA

##### *Changes Caused by Them in the Circulation of the Uterus*

Sixteen specimens were obtained where a submucous myoma was the principal condition present. In addition, 3 of the 12 speci-



Fig. 49 Adenocarcinoma of the body of the uterus (small intramural myomata also present) venous injection (metrorrhagia arising two years after the menopause) X 1. Photograph of a cross section of the fundus of the uterus. Nullipara, aged 55, arteries injected with bismuth and veins with ultramarine blue, menopause at 51, metrorrhagia of two years duration. Small intramural myomata are also present in the uterus though none appears in this section. The carcinoma occupies the greater portion of the posterior uterine wall. The growth contained very few veins—the dark area in the center is blood in the tumor which was not washed out. The venous injection mass did not escape into the uterine cavity but the arterial did. See next illustration.



Fig. 50 Same specimen shown in preceding illustration arterial injection. Radiograph of a cross slice 3 mm thick, photograph of the same shown in the preceding illustration, arteries injected with bismuth. The arterial supply of the uterus is diminished due to patient's age, 10 years after the menopause. The carcinoma has an arterial blood supply but less than the myometrium. The bleeding arose from the carcinoma and is of arterial not venous origin, as when it occurs from the endometrium.

plexus of the myometrium as do the intramural myomata of their size (Figs 41, 44, 45 and 46). Their relation to the endometrium is interesting. In two of the specimens the adenomyoma was in no place continuous with the endometrium (Fig 47). In the remaining ten, it was continuous with it, and in four surrounded nearly the uterine cavity. I recently operated upon a patient (not in this series) in which an adenomyoma was present in each tube at its origin from the uterus. Four of the twelve specimens suggested the simultaneous development of the tumor in each cornu (Figs 44, 45 and 46). In my specimens the endometrium lining the uterine cavity over these tumors was thinner and less vascular than the endometrium lining other portions of the uterine cavity (Fig 43).

In five menstruation was unaltered by the myomata (including adenomyomata) present. In two of these menstruation was moderate in amount, while in three it was profuse but not excessive. A radiograph of a cross slice of the uterus of one of these with moderate menstruation is shown in Fig 43 and the other, with a similar menstrual history, contained small discrete intramural myomata, in one of which areas of mucosa were found

The three with profuse but normal menstruation are shown in Figs 42, 45, and 46. Five gave a history of menorrhagia, two of these specimens also contain a discrete ordinary submucous myoma and intramural myomata in addition to the adenomyoma. In the other three the adenomyoma was apparently responsible for the menorrhagia, although bilateral ovarian cysts were present in two of these three, and small ordinary intramural myomata were also present. These three are shown in Figs 41, 44, and 47. Two gave a history of metrorrhagia, one profuse, the other scanty. In the one which was profuse a polyp and small intramural myomata were present, in the one with occasionally "spotting" an ordinary submucous myoma, small intramural myomata, and tuberculosis of the endometrium were present in addition to the adenomyoma.

Only two of the twelve patients were flowing at the time of the operation, and only one of these lends itself to the study of the source of the bleeding in adenomyomata, as the other contained an ordinary submucous myoma, had tuberculosis of the endometrium, and had been curetted a few days before. The first one (Fig 44) showed that the venous flow escaped from the endometrium over a portion of uterus not involved by the tumor.



This subject needs further investigation, but the clinico-pathological study of my twelve injected specimens shows that these tumors do not necessarily disturb menstruation—five of the twelve did not—and that when menorrhagia or metrorrhagia is present it may be due to an ordinary myoma, as three of these had ordinary submucous myoma in addition to the adenomyoma or some other well-known possible cause of these symptoms. On the other hand, I believe that adenomyomata sometimes give rise to abnormal uterine bleeding, as in the cases shown in Figs 41 and 44. These cases suggest that the etiology of the bleeding is similar to that in other myomata and apparently does not arise from the tumor, but as in others is due to the uterine insufficiency, i. e., the inability of the uterus to control its increased venous circulation and prevent an excessive flow of venous blood at the menstrual period.

#### SUMMARY OF CASES CLASSIFIED ACCORDING TO THEIR MENSTRUAL HISTORY AND CONDITIONS PRESENT

Forty seven of the patients gave a history of not having had any disturbance in menstruation. Of these, 22 had small intramural and some small subserous myomata, 17, medium size and large intramural myomata, 5, adenomyomata and small intramural myomata, 2, large subserous and small intramural myomata, and 1, a submucous and small intramural myoma.

Sixty-four gave a history of profuse menstruation often prolonged, i. e., the so-called menorrhagia as the predominating type of abnormal bleeding. Thirty nine of these had intramural tumors encroaching upon the uterine cavity as the apparent cause; in 10, a submucous tumor was present, small intramural tumors not encroaching upon the uterine cavity were found in 9, adenomyoma with other varieties of myomata were found in 5, small intramural tumors with a polyp were found in 2.

Thirty nine gave a history of irregular bleeding, i. e., metrorrhagia as the predominating symptom. Carcinoma of the cervix with intramural myomata was found in 8, carcino-

ma of the body of the uterus with myomata in 5, polypi and small intramural tumors in 5; small intramural myomata not encroaching upon the uterine cavity, 4; large intramural myomata, 3, adenomyomata with other forms of myomata, 2; tubal pregnancy and myomata, 3, incomplete abortion with myomata and infection (one puerperal, other probably gonorrhoeal), 2, hydatiform mole with myomata, 1, sarcoma, 2.

This grouping shows that any one variety may or may not alter menstruation, and that the bleeding present, especially if of the metrorrhagic type, is often due to some other condition.

#### THE INFLUENCE OF UTERINE MYOMATA ON THE AGE OF THE MENOPAUSE

Myomata, except very small ones, increase the amount of blood in the utero-ovarian circle. The ovarian arteries and veins are hypertrophied as well as the uterine. The excess over the normal amount of blood is apparently for the most part diverted to the uterus, and there diverted to the tumor. The usual physiological arterial sclerosis incident to the approaching menopause would probably affect a larger vessel less quickly than a smaller one. We would expect that an efficient blood supply to the ovaries would be maintained at a later age in women with myomata than those without, and, therefore, the functional activity of the ovaries in such women would persist longer, even though the excess over the usual amount of blood is apparently diverted to the uterus. The same would also hold true for the uterus, especially if it contained intramural myomata; i. e., we would expect that the endometrium or portions of it would maintain its circulation at a later age than in the non-myomatous uterus. The generally accepted view is that the menopause is delayed in women who have myomata, and my studies confirm this. Sixteen of the 150 patients had passed the menopause; the earliest age at which this occurred was 45 (had two very small intramural myomata), the next earliest 48, and the latest 56. The average age of the menopause in the sixteen patients was 51½ years.

## SARCOMA AND MYOMA OF THE UTERUS

Sarcoma was found in only two specimens. The first patient, a nullipara, was 50 years of age and had been bleeding for 6 months. Small intramural myomata were present, and the uterine cavity was filled with a growth which protruded partially from the cervix and extended through the uterine walls and invaded the adjacent structures. It was impossible to state if it was primarily sarcoma or sarcoma had developed in a myoma. This specimen was so badly mutilated in its removal that it could not be satisfactorily injected. The patient died six months later, and at autopsy an extensive local recurrence was found, and metastases were present in the lungs.

The second patient, a nullipara, was 57 years of age. Irregular uterine bleeding was of six months' duration, and began two and a half years after the menopause. The uterus contained several small myomata, a large intramural myoma, and a submucous myoma. A small area of the submucous tumor showed sarcoma. The blood supply of this area seemed similar to that of the myoma in which it had developed. It contained vessels filled with the arterial injection mass, but did not show any filled with the venous mass. The *arterial and not the venous mass* escaped into the uterine cavity (Fig. 48); i e., the bleeding was of arterial and not venous origin, as occurs in uterine bleeding arising from the endometrium. The patient died six months after the operation, with symptoms of bronchitis and pleurisy (tapped and fluid removed from pleural cavity), thus suggesting pulmonary metastases. An autopsy was not obtained.

## CARCINOMA OF THE UTERUS AND MYOMATA

Eleven uteri were removed for carcinoma of the cervix while collecting this material and injected as a routine procedure. Myomata were found in eight specimens; in seven the myomata were small and of the intramural type. In the eighth small myomata were present, and in addition a large intramural myoma and a myoma of the cervix; the latter was of the submucous type and protruded into the vagina. The youngest patient was 32,

and the oldest 57; the average age of the eleven patients was 43+ years.

Five uteri were removed for carcinoma of the body, and in all, small intramural myomata were found. The youngest patient was 50 and the oldest 62; the average age of the five patients was 57+ years.

It is impossible to draw any conclusions from such a small number of cases, but they emphasize the frequency with which myomata are found associated with carcinoma of the uterus and, especially, with carcinoma of the body, to which references may be found in the literature.

It is very difficult to obtain a satisfactory injection of either the arterial or venous supply of the cervix of a uterus removed at operation, because the injection mass escapes from many small cervical vessels which are injured at the operation, and the injection of all my specimens on this account was incomplete. Nevertheless they showed that carcinoma of the cervix has an arterial blood supply, apparently less than the normal cervix, and as in myomata it is difficult to demonstrate any veins. The *arterial injection mass* and *not the venous* escaped from the growth during the injection of the specimen. The necrosis incident to the growth leads to destruction of portions of the cancer and injury to its arteries, with subsequent hemorrhage of *arterial, not venous, origin*. My studies of the blood supply of carcinoma of the cervix are unfinished and must be reserved for a later publication.

The injection of uteri containing carcinoma of the body is easily accomplished, and my specimens showed that this type of growth has an arterial blood supply, but less than the myometrium, and that they are also deficient in veins. In every instance, the injection mass which escaped from the growth was *arterial and not venous* (Figs. 49 and 50).

## OVARIAN CYSTS AND UTERINE MYOMATA

We are aware that the ovaries are responsible for the changes in the uterus leading up to the menstrual flow, and that it is possible that they are of importance in the regulation of the amount and duration of the flow. Therefore, disturbances in the circulation of the

uterus may influence the functional activity of the ovaries and lead to changes in the ovaries. The ovaries of patients having myomata often are apparently normal, even in those causing marked changes in the circulation of the uterus. At times they are enlarged, the so-called "myomatous ovaries," and at times cysts are present. I have not studied the ovaries of all my specimens histologically, as in many instances they were not removed or only one was removed. In seventeen instances ovarian cysts were found, and in twelve of these the operation was undertaken for ovarian cysts and the myomata were of secondary importance. Carcinomatous ovarian cysts were found in two instances, dermoids in two, bilateral hemorrhagic ovarian cysts in eight, Graafian follicle cysts in three, bilateral infected ovarian cysts in one, and adenocystoma in one. Of the 150 cases, 17 were associated with ovarian cysts, and 8—i. e., nearly half of these—were associated with bilateral ovarian cysts containing a thick bloody material in the cavities of the cysts. Of the 17 specimens with ovarian cysts, 5 were associated with adenomyoma. Of 12 cases of adenomyoma of the uterus (also containing other forms of myomata), 5 of them were associated with ovarian cysts, as compared with 138 cases of myomatous uteri not containing adenomyomata and associated with ovarian cysts in only 12 instances. The ovarian cysts associated with the adenomyomata were not all of the same kind. In four of the five the cysts were bilateral, and the one that was unilateral had had a previous operation in which an ovary had been removed for a small cyst. The cysts in two instances were apparently Graafian follicle cysts, in two others the cysts contained the hemorrhagic material mentioned above and in the fifth bilateral infected cysts were present. Of the 17 cases, only 6 gave a history of menorrhagia or metrorrhagia, and in all 6 myomata of a type apt to cause uterine bleeding were found.

The patients with dermoid, cancerous cysts, and cystadenoma, associated with myoma, were probably accidental associations, and the same may be true of the others. The significance of these findings, especially the

apparent frequency of adenomyoma associated with ovarian cysts, is based on too small a number of cases from which to draw any conclusions.

#### SUMMARY

As a result of ovarian activity, the uterus undergoes periodic changes which manifest themselves clinically by the menstrual flow. The flow is preceded by changes in the venous plexus of the endometrium, permitting the escape of blood into the tissues of the latter. The duration of the flow and the amount of blood lost is probably dependent upon many factors, such as changes in the endometrium, the time necessary for the repair of the altered endometrium, the degree of venous congestion of the uterus and the ability of the uterus to control its venous circulation. These factors are not entirely evident in anatomical conditions which we can detect, but are probably controlled mainly by the functional activity of the uterus, the ovaries, and, possibly, other structures and the interrelation between these. I have demonstrated that menstruation is mainly, if not entirely, a venous flow and can occur only when there are changes in the venous plexus of the endometrium, permitting the blood to escape. As there are not any valves in the uterine veins, the duration of the flow and the amount of blood lost is dependent upon several factors, and, especially, the ability of the uterus to control its venous circulation, i. e., to prevent an excessive escape into the uterine cavity when there is a leak in the venous plexus of the endometrium, as occurs at the menstrual flow. The most important factor in controlling the venous circulation would be the muscular efficiency of the uterus and the regulation of the same, however it may be accomplished.

Small subserous myomata are relatively anæmic and do not have any appreciable influence on the uterine circulation.

Large subserous myomata are very vascular (arterial), and cause a hypertrophy of the uterine artery from which their nutrient artery arises, and thus more blood is carried to the uterus and tumor, the excess over the normal being diverted to the tumor. More venous blood is carried back to the uterine

and ovarian veins. The chief arterial and venous changes are in the peripheral zone of the uterus; the radial zone and endometrium are but very little affected, and menstruation is usually not altered.

Small intramural myomata are less vascular than the myometrium and apparently have very little influence on the circulation of the uterus, and usually menstruation is not altered. As cases sometimes occur with a history of menorrhagia or metrorrhagia in which small intramural myomata are found, these cases suggest that those tumors may in some way lead to uterine inefficiency, especially muscular inefficiency, with a resulting loss of control of the venous circulation of the uterus.

Intramural myomata over 2.5 cm in diameter are usually more vascular arterially than the myometrium, but less vascular venously. Some of the large tumors are so very vascular that the injected specimen appears more like an arterial angioma than a myoma. The greater the arterial supply of the tumor, the greater the increase in the arterial supply of the uterus containing it, but, as in the subserous variety, at least, the greater part of the increase over the normal is diverted from the uterus to the tumor.

The venous plexus of the myometrium is always dilated, and this is most marked about the periphery of the tumor, and especially in places where the pressure is least. The venous uterine congestion is apparently mainly an active one, and the uterine walls are apparently hypertrophied in order to control it. The endometrium, if not encroached upon by the tumor or tumors, is often hypertrophied, and its venous plexus is also dilated. Menstruation may or may not be affected, and when excessive or abnormal bleeding occurs it is apparently due to a loss of uterine efficiency; i. e., the uterus is unable to control its dilated venous plexuses, and, there not being any valves, it is unable to prevent the escape of an excessive amount of blood into the uterine cavity at the menstrual flow. The regenerative changes following menstruation, i. e., menstrual involution, is also sometimes retarded. This may be due to changes in the endometrium, which are

possibly dependent upon the disturbance in circulation.

Intramural myomata which encroach upon the uterine cavity alter the shape of the cavity and intercept or push to one side the radial arteries which supply the endometrium over the tumor, and this, with the pressure exerted by the myoma, causes an atrophy and anemia of this portion of the endometrium. The endometrium directly opposite the tumor may also be thinner and less vascular than normal, due to the pressure of the tumor. The endometrium not directly or indirectly encroached upon is always thicker and more vascular, and is often actually hypertrophied and its venous plexus more dilated than normal. The condition of the endometrium in any specimen is dependent upon the age of the patient and the phase of menstrual cycle when the uterus was removed. The menstrual flow arises mainly from the endometrium not directly or indirectly encroached upon by the tumor, i. e., the endometrium, which has an abundant blood supply, contains glands and is usually hypertrophied. The atrophied, anemic endometrium over the tumor which has a poor blood supply, and in which the glands are few in number or entirely absent, takes a very small part or none at all in the menstrual flow. Disturbances in menstruation may or may not occur. The profuse flow, when it occurs, is only in a measure dependent upon the increased amount of venous blood in the plexuses of the myometrium and endometrium, the larger channels uniting the two plexuses, and the hypertrophy of portions of the endometrium and the distortion of the uterine cavity making it more difficult to close. This disturbance is apparently due more to the failure of the uterus to control the venous blood under these adverse circumstances, and a retardment of the regeneration or repair of the endometrium. Two specimens may appear the same, yet in one, menstruation is normal, and in the other, excessive; nor can we discern anatomically why both should not give the same menstrual history. Occasionally, dilated veins in the endometrium over the surface of the tumor may become eroded and give rise to abnormal bleeding, but the usual and chief source is

from the portion of the endometrium described above.

Submucous myomata represent a later stage of the intramural variety, and the veins over the surface of the tumor are more apt to become injured or undergo degeneration than those over the intramural tumors. The source of the profuse menstruation is usually the endometrium not encroached upon by the myoma. Menstruation is more often abnormal, but may be normal.

I have not studied a sufficient number of specimens of adenomyomata to state definitely the source of bleeding when this variety is present. Only twelve uteri were encountered containing these tumors, and in all twelve other types of uterine myomata were also present. These cases showed that disturb-

ances in menstruation are not necessarily present, and when they occur they may be due to changes caused by other myomata in the specimen. On the other hand adenomyomata may cause menorrhagia or metrorrhagia, just as other intramural myomata encroaching upon the uterine cavity do. When abnormal bleeding is present, it is apparently dependent upon the same factors as other types of myomata, and the excessive flow does not arise from the tumor itself. This variety must be reserved for further study.

My studies have led me to believe that when the bleeding arises from the tumor itself, due to sloughing or sarcomatous changes, it would be arterial (the tumors have a rich arterial supply), and not venous, as occurs from the endometrium.

## TYPHO-TUBERCULOUS TUBO-OVARIAN ABSCESS

By WM. D. TULLERTON, PH. B., M. D., CLEVELAND, OHIO

THE case I have to report has proved to me to be one of great interest, the finding of both the typhoid and tuberculous infections being accidental and entirely unsuspected. Then also, on looking up the available literature on the occurrence of typhoid infections of the female genital organs I find but three cases reported definitely, one each by Gans (1), Koch (2), and Dirmoser (3), and the bacteriological study of the case of the last author leaves a doubt as to whether the organism recovered was really the *B. typhosus*. More often have I found typhoid pelvic infections merely alluded to and the statements made that such infections may occur, but no instances cited. Henning (4) states that hemorrhagic salpingitis may accompany the acute exanthemata, and that toxic irritation may give a mild salpingitis, typhoid fever being one of the etiological factors for the toxemia. Dürk (5) believes that acute infectious oophoritis may be caused by the *B. typhosus*. Von Henkelom-Sregenbeck (6) in his work on "Pathogenesis of Diseases of the Adnexa," states that ty-

phoid may be an etiological factor. Lebedinsky, Skrobansky (7) and others, have shown that with the acute infectious diseases, among them typhoid fever, the ovaries undergo changes varying from cloudy swelling to acute parenchymatous inflammation, similar to the changes in other parenchymatous organs in these infections, and furthermore, that neither the severity nor the duration of the disease has any relation to the amount of degeneration found, mild infections giving marked changes and vice versa. These changes if mild, clear up as elsewhere, but if severe and extensive, may, as Lebedinsky states, affect the reproductive activity or give rise to chronic trouble with these organs.

Dobbin (8) has reported a case of puerperal infection from which *B. typhosus*, streptococcus and staphylococcus were all recovered. The bacteriological study of this case makes it certain that the typhoid bacillus was recovered, and Dobbin believes that the patient was infected at the time of delivery by a midwife, the patient occupying same room and bed in which her husband had died a short

time previously of typhoid fever. Hirst (9) states that he has at different times recovered the typhoid bacillus from the puerperal uterus, enabling him to make a diagnosis of typhoid fever when sepsis was suspected.

From this summary it will be seen that pyogenic typhoid infections of the female pelvis are either rare or seldom observed and almost never reported. The case I have to present is as follows:

Mrs F., Gyn. No. 4486, a married German woman of 25, entered the Lakeside Hospital August 15, 1912, complaining of "pain in the right side and back for the previous three months, and of feeling very weak and tired."

#### *Family history* Unimportant

*Past history.* Always healthy as a child. When twelve years of age a thyroid enlargement was noticed which increased gradually in size during the next nine years, then, four years ago, she had a thyroidectomy in Prague. Neither during the past nor careful questioning or at present on careful examination, were any of the symptoms of Graves' syndrome discovered, except a moderate exophthalmos, which the patient said she had always had. The patient on admission had a rounded, symmetrical, fluctuating, subcutaneous tumor, 3 cm. in diameter, which seemed to arise from the thyroid isthmus. There had been no cough, hemoptysis, night sweats, tachycardia or gastric distress, though she had lost twenty pounds in weight during the previous three months. Bowels were regular daily. Menstruation began at seventeen years, was regular every four weeks, flowed moderately for three days, the flow being accompanied by a great deal of pain, mostly in the lower part of her back. She had been married ten months, no children or miscarriages. Her husband had gonorrhea four years previous to his marriage, was carefully treated and apparently cured. The patient gave no history of venereal disease nor did she admit any of their signs or symptoms. She had never had any pelvic trouble until her present illness.

*Present illness.* Fourteen weeks previous to her admission the patient had pain in her right lower quadrant, which her physician diagnosed appendicitis. She refused operation. After two weeks' medical treatment, during which time her condition improved slightly, she suddenly became worse and called in another physician, then, three months prior to admission, the patient went to bed with a persistent bad headache which lasted for a week or more. At this time she had fever which persisted for slightly more than three weeks. Her bowels were loose and once she remembers having seen some blood with them. She was slightly delirious at times and had some slight burning on urination. She was kept on a liquid diet.

The pain in her right lower quadrant which had

been continuous since her attack of typhoid, but which had gradually become much worse, with acute attacks many times during the day, had practically confined her to her bed and rendered her incapable of any exertion. The pain was not noticed at night, as she slept well.

*Physical examination on admission.* The patient was a rather poorly nourished woman, somewhat anæmic. The thorax was long and thin, with some flattening of the infraclavicular region, the depth of the supraclavicular fossa on the right side was greater than on the opposite side. Over the upper right side, expansion lagged slightly and was somewhat diminished. Vocal fremitus was increased and the percussion note was slightly higher pitched and dulled in tone.

Faint moist râles were heard during inspiration. The heart was somewhat enlarged though the sounds were clear. There was rather marked tenderness in the lower abdomen and some muscular rigidity.

*Pelvic examination.* The outlet was in good condition, the cervix crossed the axis of the vagina and was normal. The uterus was small, the fundus forward and fixed. On the right, extending down into the cul de sac, was a firm, hard mass, which seemed to have softened areas. The left side was also adherent. The physical examination was otherwise unimportant.

On admission the urine was normal, the W. B. C. 15400 to the cu mm, Hb 70 per cent, B P 105 mm. Hg, Temp 100, pulse 98.

*Operation.* Two days after admission, a short median incision was made and the pelvic structures found densely adherent. Both tubes and ovaries formed pus sacs which ruptured on freeing the adhesions. The right broad ligament formed a phlegmon about 2.5 cm. in thickness, extending from the uterus to the pelvic wall. Both tubes and ovaries, with the phlegmon of the right broad ligament, were removed and the pedicles cauterized. The appendix was normal and removed. The abdomen was closed without drainage.

The patient made a fair recovery from her anæsthetic, nitrous oxide and ether, but by consulting her temperature chart it will be seen that the day following operation her temperature rose to 102.5. Her temperature varied from 99 to 102.5 for the next six days. Her wound was then dressed for the first time and was found to be broken down. Iodoform tape drains were inserted and thereafter the wound dressed daily. The day following the first dressing her temperature began to drop, the following day reaching 98.5. Then, except for an unexplained rise to 103.5 on the eleventh post-operative day, the temperature gradually sought a lower level, but continued to show a morning drop and evening rise.

The patient was discharged thirty-five days after the operation, the abdominal sinus still discharging slightly. I might add that now, seven months after her operation, the sinus is not entirely healed. Hygienic measures were advised and the patient has

gained twelve pounds in weight and feels very comfortable in every respect.

*Pathological examination* In the gross, the specimens removed at operation were so inseparably bound and matted together as to be almost indistinguishable. Imbedded in the mass from the right side was a collapsed, thick walled abscess, the lining of which was thick, of a dirty white color, densely attached to the underlying tissue and very much roughened and inflamed. In the mass from the left side a differentiated portion of the tube was patent for 1.5 cm and filled with pus. The surface of this mass at one place resembled the lining of the abscess on the right side.

Microscopically, the picture of both of the tubes and ovaries were the same and were as follows: *right tube* is much thickened, the villi of the lumen are destroyed and replaced by necrotic material and leucocytes. Here there are many epitheloid cells forming tubercles which contain numerous giant cells. The muscle walls are greatly infiltrated with small round cells, and the surface shows an abundant growth of granulation tissue in which there are a few necrotic areas. *Right ovary:* The tunica albuginea is thickened and the cortex shows a few primordial and Graafian follicles. There is an increase in fibrous tissue and a marked round cell infiltration. The medulla and one side of the ovary are replaced by granulation tissue and necrotic material, through which are scattered many typical tubercles, surrounding the necrotic tissue there is an almost solid wall of round cells.

At operation, swab cultures were taken of the pus from the pelvic abscesses. Examination of the smears from these swabs showed a rather thick, short, bacillus, with rounded ends, and on staining with methylene blue I was particularly impressed by the irregularity in the staining and the presence of numerous polar bodies. The growth of these organisms on all ordinary media corresponded to that of the *B. typhosus*, in subculture they were much more regular in their staining. The organisms were actively motile, decolorized with Gram's stain, did not ferment glucose, and agglutinated completely in one hour with typhoid serum in a strength of 1-50. For this Widal reaction I am indebted to Dr. Keyser of the Lakeside Hospital.

With these facts, I doubt if anyone could doubt the specific types of this double infection. The question of which was primary and the probable mode of infection will be discussed later.

Now, since in them there are some points of similarity to my case, let me give a brief summary to the cases of Koch and Dirmoser referred to above. Koch's case was that of a woman of twenty-eight, who had had typhoid at fourteen. She came to the clinic and was diagnosed pelvic inflammatory disease. At

operation the free fluid found in the pelvis was sterile, but mucopus from a cystic tubo-ovarian mass gave cultures of *B. typhosus*. That of Dirmoser was a woman of twenty who had had typhoid, the onset of which was five months previous to the onset of the symptoms of her present illness, which was one month previous to her admission. At operation the lower intestines were bound together and adherent to the anterior abdominal wall. A tumor the size of a child's head was adherent to the bladder in front, and attached to the right ovary, uterus and intestines. This tumor, a thick walled abscess, contained a greyish yellow, stinking pus. There was an abscess and pyosalpinx on the left side. Microscopically the pus showed no organisms, but cultures gave colonies of the typhoid-colon group, the organisms of which were fairly bacilli, stained Gram negatively, did not ferment sugars or produce an indol reaction, but did cloud broth. They were considered to be *B. typhosus*.

We are all aware of the frequency of post-typhoid suppurations and infections, in which the typhoid organisms are the etiological factor, such as osteomyelitis and the so-called typhoid spine, cystitis, cholecystitis, etc., and even circumscribed typhoid intercranial supuration has been described.

With perfected technique, the constant finding of typhoid organisms in blood cultures in the early stage of the disease proves without a doubt that at this stage the disease is a septicæmia.

We know that the condition induced by one organism favors the growth of other pathogenic forms (10). Why, then, is it not reasonable to suppose that these organisms, finding their way as they do to all parts of the body, should not, on finding a focus which is already diseased and the resistance lowered, find there a point most suitable for multiplication?

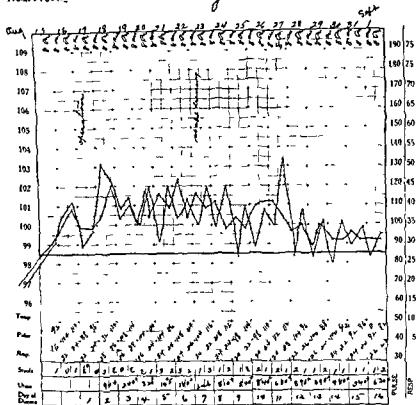
Other modes of infection are possible, but I do not believe so plausible. For instance, the infection may have been an ascending one through vagina and uterine canal, the organisms coming from the perineum. There is, however, considerable evidence to show that except in cases of gonorrhœa or puerperal infection, this mode of infection rarely occurs.

No. 9756

## THE LAKESIDE HOSPITAL

Name *Mark F.*Admitted *Aug 15*

1912 Ward 03



Kelly (11) is of this opinion, and the experiments of Menge and Kronig, who introduced streptococci and staphylococci into the vaginas of pregnant women, showing that in twenty-four hours vaginal cultures were sterile, is evidence that the vaginas, at least of pregnant women, are quite resistant to infection. Pollock has shown that with other infections of the vaginal mucosa, especially gonorrhœal, the vaginal mucosa loses much of its power of resistance, and pyogenic and intestinal organisms are usually present.

In the case I report, however, there was no evidence or history of any such previous infection.

Koch believed that the route of infection in his case was by the organisms wandering

through the gut into the abdominal cavity, and then finding their way into the tube. I doubt whether such an infection would be possible except with a perforation, which was not present in any of the cases reported, for had the wandering organisms been but few in number, the leucocytes would have taken care of them, and if the number of organisms were great other intestinal organisms would have accompanied them and a peritonitis resulted. Dirmoser is of the opinion that in his case the organisms wandered out of the large gut into the lymph spaces, then into the surrounding connective tissue, finally finding their way into tube and ovary. He admits the possibility of its being a hæmatogenous infection, but does not consider it so probable.



These theories, along with the possible penetration of the rectum or bladder by the organisms, with ultimate location in the tubes and ovaries, are practically, theoretically, and atomically so much more complex and improbable that, carefully considering all probabilities, I am very much in favor of the view that my case, at least, was hæmatogenous in origin.

Stone (13) has seen numerous cases of secondary tuberculous infections, but does not say what the primary infections were, though he states that he does not believe the primary infection invited the secondary infection, a statement in which I cannot agree with him. However, considering the advanced and extensive state of the tuberculous infection seen microscopically, one can scarcely doubt that the tuberculous pelvic condition, in my case, preceded the typhoid infection. Weight is given this supposition by the fact that the patient had a pulmonary tuberculosis, which was very likely primary to the tuberculous condition in the pelvis.

It is quite probable that the pelvic tuberculous condition was accentuated and progressed more rapidly with the subsequent typhoid infection, for, as Ravenel (12) points out, tuberculosis of the lungs with cavity formation, which is peculiar to man and the higher apes, is always a mixed infection, and being mixed, progresses more rapidly than in the lower animals which are not highly susceptible to other organisms.

In closing, I might add that, though the number of organisms infecting the female pelvis is fairly extensive, but two cases of infection with so common an agent as *B. influenza* are reported, one an infected pyohydrosalpinx by Kiskault (14), and a case of puerperal infection with isolation of the influenza bacillus from the uterus, by Thalheimer (15).

#### CONCLUSIONS

1. That in post-typhoid pelvic abscesses, the *B. typhosus* probably plays a more important rôle than is suspected.
2. That puerperal infections coincident

with or shortly following a typhoid infection may often have the typhoid organism as a causative agent.

3. With these conditions, a careful inquiry into the past history for typhoid infections will probably bring out some interesting results, especially when coupled with a careful bacteriological examination of all pus from pelvic abscesses.

4. That with a previous pelvic infection, which is more or less destructive and lowers the resistance of the parts, one would naturally more often expect to find a secondary infection.

5. That the simplest and most plausible mode of infection is by way of the blood stream.

6. That hexamethylenamin, which has proven so useful in preventing post-typhoid cystitis, cholecystitis, etc., though its excretion by the uterine and tubal epithelium has not yet been proven, may here be found to be of advantage, at least in the prevention of such a post-typhoid complication.

I wish to thank Dr. Hunter Robb for his kindness in permitting me to report this case, as it was in his service in the Lakeside Hospital that the case occurred.

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# HOW CAN WE IMPROVE THE RESULTS OF OUR OPERATIONS FOR CANCER?<sup>1</sup>

By TRUMAN ABBE, A. B., M. D., WASHINGTON, D. C.

IN looking over the mortality records of the census area of the United States, one finds, alarmingly near the head of the list, a condition that is all too well appreciated by the surgeon, namely, cancer. The death rate per hundred thousand inhabitants has increased from 64 in 1900 to 69 in 1905 and 76 in 1910. In the state of Massachusetts, where we have figures extending over a longer period, the cancer death rate doubled between 1850 and 1875, and since then has nearly doubled again.

We all recognize cancer as primarily a surgical condition, surely curable by wise eradication in its early stages. And yet when we look at the results of our treatment of cancer they are most disheartening. Of the breast cancers coming to the surgeon nearly a quarter are already inoperable and at least one half of those operated on eventually die of recurrence. Even in the most favorable cases, seen in the first six months and before the cancer invades the axilla, the reports of our large clinics show that one in five dies of the cancer. In cancer of the uterus when clinical symptoms appear it is already very likely to be too late for eradication of the condition. From forty to eighty per cent are conceded to be already inoperable, and of those operated on in the favorable cases possibly one in four lives more than five years. Sampson says that in half of the cases operated on, the cancer has already extended beyond the uterus, and what is called recurrence is truly but a continuation of the growth. In the cancers of the stomach and intestines (which make up nearly one half of all the cancers) two thirds are inoperable when the diagnosis is made, and even then at the Mayo clinic nearly two thirds of those operated on have to be contented with hopeless exploration or a palliative operation. Even of those radically operated on, not much more than three per cent live beyond five years. Such reports

surely justify and emphasize the importance of the consideration of means to improve the results of our cancer operations.

The first question that arises is whether we have any other satisfactory line of treatment. The last six months have brought out several suggestions for constitutional treatment that offer some hope. In Germany, Wassermann tells of experimental work on mice with an eosin-selenium compound which, injected into the blood, has a selective action on cancer cells, killing them. He has published no results of work on man. In Rome, Fischera has started work on an autolysate from human fetuses, which he has injected with apparent cures in twenty-five per cent of his eighteen inoperable cases. In New York, Berkeley and Beebe are trying a vaccine from the serum of mammals into which they have injected human cancer, and they report marked benefit. But all this work is too new to be relied on at present, as our previous experiences in these lines have proven unsatisfactory; so that the local eradication of this disease must still be given first choice in the line of treatment.

For the local eradication of the cancer certainly the knife is the most serviceable instrument. In certain cases of cancer of the cervix and in some skin cancers, *cautery*, either actual or chemical, and *radiotherapy* have a very distinct usefulness. In some apparently hopeless cases of cancer of the cervix the cautery does what seems a miracle. And in skin cancers, especially about the face, radiotherapy is undoubtedly taking the place of the knife. In fact, the Röntgen ray has demonstrated its usefulness to such an extent that it is being adopted more and more after all cancer operations. Such a use of radiotherapy, done with circumspection, undoubtedly will prevent recurrences in some patients and prolong life of more, thus improving our operative results.

The surgeon himself, however, can greatly

<sup>1</sup> Read before the Washington Surgical Society, May 27, 1912 (See discussion, p. 227)

help the results of the operative treatment. First, in the *careful selection of the cases* suitable for operation. Confidence instead of doubt can be won for the surgical treatment of our cases by the painstaking diagnosis of inoperable conditions before starting the operation. In the breast cases, the presence of distant metastases, especially in the mediastinum, the involvement of supraclavicular lymph nodes or the chest wall all exclude operative cures. In the uterine cases the involvement of vaginal wall, bladder, or rectum, or the iliac glands, practically excludes cures. In the stomach cases, Boas says that the clinical symptoms are never present in the stage adapted to operative cure. Certainly the involvement of the supraclavicular node, the umbilicus, the rectum, and the ovaries, all of which he frequently finds, excludes any operative cure. He calls special attention to the danger of finding the metastatic mass present in twenty to thirty per cent of gastro-intestinal cancers in its usual seat in the rectum, on the anterior wall two to four centimeters above the prostate, not ulcerated, and not growing from the mucosa, and thinking that mass the primary growth, though primary rectal growths almost always start from the mucosa and show ulceration. He speaks also of venous thromboses in the legs as showing the existence of cancer in the blood. He would have us sift out all these inoperable cases by very careful examination before making even an exploratory laparotomy, and save the discomfort of finding the condition inoperable after starting the operation. If we can sift out the incurable cases and tell the patient or his friends the impossibility of cure without operating, and that we can do only a palliative operation, we gain the confidence of the laity in place of their distrust of our ability and show them the importance of seeking help early, instead of having the people blame the surgeon for inadequate work. Mayo says, "If cancer surgery is in disrepute, it is because too large a proportion of patients is accepted for operation without explanation, at a stage when there is no possibility of cure and when the patients or their families should have been informed of the hopeless condition

If left without operation they would have been living examples of ill-advised delay instead of the unsatisfactory results of ill-advised surgery."

Second, we all appreciate the importance of doing *radical early operations*, removing the near lymph nodes, with the tumor, by *block dissection*, even before the lymph nodes show gross signs of involvement. And yet how often we see incomplete operations, not merely incomplete in not removing nodes but in doing too limited a local operation. Some of us are too likely to think of wound closure before cancer eradication. We all have had to do over cancer operations for local recurrence after a primary operation, by ourselves as well as by others, and yet we still at times try to persuade ourselves that in this particular case a less extensive operation will suffice, that in this cervix case we need not clear out all the loose pelvic tissue along the iliac vessels; that in this breast case, with a mass only the size of a hazel nut adherent to the skin, we need not clear out all the axilla and the deep pectoral fascia, that in this lip case we can wait a little longer until there is something palpable under the chin or in the neck before we do a radical operation. And yet we know that we should do the extreme operation at the outset. Warner's figures from the Heidelberg Cancer Institute show that seventy per cent of all cancer recurrences are local—from incomplete operations. To be sure a very large number of our cancer operations are done at a stage when thorough removal is not possible. But when we do get the opportunity we certainly ought not to let it slip from us in the vain hope that the tumor mass embraces all vestiges of the cancer. To what extent we must be radical will always remain to be decided for each case on its merits by the judgment of that surgeon.

The danger of the limited operation has been brought out forcibly by Paine and Nicholson, who showed by experimental surgery on mice that incomplete removal of the cancer caused early recrudescence in twenty-three per cent of the cases and that this recrudescence was much more virulent than before the operation, developing at a rate two or three times as fast as the similar growths

in control animals. So that if we do not do a complete primary removal it is questionable whether any operation should be done, for we must bear in mind the chances of hastening the patient's end.

Third, in the *technique of operation* the surgeon has one or two points to consider. Coffey has noted in breast operations, during the period when the operation was done from the chest towards the axilla, that recurrences appeared in the axilla, and that now, with the type of operation starting at the axilla and working towards the chest wall, the recurrences appear in the chest wall. This he attributes to the manipulations of the cancer tissue during the operation, squeezing out the cancer elements into the wound. If this is the true explanation, then there is also a squeezing of the cancer elements through the tissues by tumor manipulation without cutting, and the least possible manipulation of the cancer area before the mass is out of the body the better. This would argue in favor of the minimum examination of the patient compatible with efficient diagnosis, and the preparation of the operative field with the least possible mechanical disturbance of the tissues, for example, the painting of the skin with iodine would be preferable to the soap and water scrubbing followed by the bichloride washing. For the same reason, during the operation the manipulation of the tumor should be as limited as possible.

Again we note the frequency of stitch-hole recurrences. We can avoid many of the stitch holes by using adhesive plaster strapping to close the wound, notably in the breast and lip cases.

So much for the work of the surgeon; but before the case comes to his hands the fate of the patient has often been determined. To get the best results from our surgery *we must get the cases in the early stages*. In some cases the patient, through ignorance or fear, refuses operation in the opportune moment of the early stage; and considering the proportion of post-operative recurrences which we acknowledge, the view of the layman is perhaps justified. But in the case where the diagnosis is made early, the layman should have quoted to him the results, not of all

cases, but of the early cases in the hopeful condition, with eighty per cent or more of cures; and when those results are instilled into the popular mind the layman will not be so likely to procrastinate. There are a certain number of cases where the family physician attempts treatment of various lines before consulting the surgeon and so delays radical treatment until too late. And that result can be remedied only by education of the physician, preferably while he is a student in the medical school, but also later, through our journals, until he appreciates that thorough early eradication is the only acceptable cure for cancer.

But still more important is the question on which we all need education. That of how to make an early diagnosis of cancer. The statement of Boas, that when a patient has clinical symptoms on which we are justified in making a diagnosis of cancer of the gastrointestinal tract, he is already beyond hope of operative cure, and that of Otto that, of one hundred and ninety-six cases of cancer of the stomach and intestines, one hundred and twenty-one died within six months of the first symptom — these statements show how inadequate the best of us are to make an early diagnosis of cancers that we cannot see or feel. We are having brought out many new tests for cancer, all still in the experimental stage but offering some hope of diagnosis. Some are based on serum reactions, some on special ferment productions, some on urine changes. The Rontgenographic study of the suspicious cases also helps in the diagnosis. Perhaps these tests will eventually lead to a diagnosis of the intestinal cancers at a curable stage.

In the cancers of the breast and uterus, while it is also true that the condition develops in many instances without clinical symptoms till beyond the curable stage, yet it is within the power of the surgeon to make a diagnosis if he examines the patient in the early stage. To make these diagnoses *we should get all women of the cancer age to return for routine examination of breast and uterus every six months*, just as most of the educated classes now go to the dentist for routine semi-annual examination of the teeth, not waiting

for symptoms to drive them to seek aid. With the teeth, the penalty is a toothache. With the breasts and uterus, the examination is more distasteful to the patient; but the stake is not the fleeting toothache with at most the cost of a tooth extraction, but months of distress and horrors, and in the end, life itself. The women will permit and even request the examination if the physicians will do their part and show them the importance. We feel that it should be the duty of every accoucheur to get each of his patients to return every six months for examination of breasts and uterus. Many of his patients do come back to him for one thing and another fully that often and his suggestion of an examination would be welcomed without question. If he finds no cancer the woman is happy. If he finds the cancer it is much more likely to be in a comparatively early stage and cure reasonably hopeful. That the examination of the parous woman would not reach all the breast and uterus cancers is obvious. Theilhaber found twenty-seven per cent of three hundred and forty-seven cases of uterine cancer in nullipara. Paus found thirty-one per cent of breast cancers in nullipara. We would do better than the accoucheur if we got all women over thirty-five years of age to present themselves for routine semiannual examination of breasts and uterus. But the medical profession must win even greater respect than it now holds from the laity before the virgin of thirty-five years, without pelvic symptoms, submits to vaginal examination. For that respect we must work.

The most hopeful line of improvement in our cancer treatment, however, is in *prophylaxis*. From the study of the cancers of which we can get a history from their incipency we appreciate that certain factors lead to the development of cancer—persistent irritation, physical or chemical. The chronic inflammation, chronic ulcer, scar, wart, mole, irritant secretion, hidden blood clot following trauma, colloid collections as in the thyroid, fibroid tumor, or for that matter benign tumor of any type, gallstone, kidney stone, the physiological changes of involution in uterus or breast, the Röntgen rays, the sunshine, keratoses in the skin from age or drugs, all are

followed fairly frequently by cancer. Hence we must educate the layman to avoid continued irritation of all kinds.

Wilson and Willis at the Mayo Clinic showed that in a very large proportion of the cases, cancer could be traced back to displaced cells which showed a tendency to revert to the embryonic type. Such displaced cells are to be seen in the chronic ulcers of the mouth and stomach, in the obliterating appendix, in the diverticula of the intestines, all of which should be removed if they cannot be promptly cured. They found evidences of previous isolation of epithelial cells in three per cent of the rectal cancers, ten per cent of cancers of the cæcum, thirty per cent of those of the lip, thirty-three per cent of those of the gall-bladder, forty per cent of those of the colon, sixty-seven per cent of cancers of the stomach, and one hundred per cent of those of the appendix. The regression of the uterus and breasts gives the same conditions; the inflammatory processes in the prostate do the same. The hypernephroma is a group of prenatal isolated cells. All these show the same tendency of isolated groups of epithelial cells to run amuck. If we appreciate these conditions as leading frequently to cancer, then we will treat these primary conditions more carefully, and if necessary eradicate them by excision or some other means before they become cancerous. Bloodgood states that of the pigmented moles which have undergone cancerous degeneration and then been operated on he has seen sixty-five cases, and not one has had a permanent cure. Yet how easy it would have been to remove the pigmented mole before its degeneration. And certainly if a mole starts to degenerate its immediate eradication is imperative.

As precancerous conditions in the cervix uteri, may be considered the unhealed lacerations that are bathed in an irritating secretion. If these lacerations are kept clean and un-irritated certainly some of the cancers would be avoided. On the penis, the tight foreskin, with its retained secretion, is very frequently evident as a precancerous condition. In the stomach, any ulcer that does not heal promptly under medical treatment should be removed rather than allowed to drift on until

the evidence of cancer development is obvious and the prognosis hopeless.

As to the effect of trauma, Theilhaber found one hundred and forty-eight cases of carcinoma and three hundred and twenty-four cases of sarcoma that followed an injury. More than half of the sarcoma cases developed within six months from the injury. Practically all of the carcinomata were in the breast, while many of the sarcomata were in the extremities. Hence we are warned to watch the traumata and tell the patient to do the same and report if the bump does not promptly go away.

The laity must be educated to feel that cancer is preventable and also curable if treated radically and early, that the diagnosis must come from the physician and not be delayed until it is evident to the patient. The work that has been done in education on the subject of cancer in Germany, started by Dr Winter and adopted by a number of medical societies in that country, has spread through ten other European nations and to parts of the United States. Winter assures us that the fear lest the patient and the public become overanxious in dread of cancer is groundless, as the physician's advice is complete assurance. Our tuberculosis work shows similarly that the dread of a disease is not increased by judicious education. Winter has planned an educational campaign covering the training of the medical student, post-graduate courses in cancer diagnosis and treatment, medical press notices (especially insisting on the results of cases where the early diagnosis was overlooked), health authority publications of leaflets for physicians and midwives, prosecution of all persons treating cancer who are not qualified physicians, and education of the public to the idea that cancer is curable. New York city has adopted a leaflet, "What every woman should know to prevent death from cancer of the uterus." The effects of this educational campaign are

already being felt in Europe, where the operative statistics show an increasing proportion of operable cases coming for diagnosis and treatment, and therefore higher percentages of permanent cures.

# SUMMARY

We all recognize that our cancer operations are too late, too limited, and often on too local a diagnosis, and that the people have the well-founded idea that our cancer operations in general are unsatisfactory and do not cure.

To get better results we must enforce certain well-established conceptions. That early eradication is at present the only reliable method of treating cancer, and operation in general the most satisfactory method of eradication, though energetic caustics and radiotherapy have their distinct fields. That painstaking diagnosis to select the cases suitable for curative operations, complete eradication at the primary operation, with the minimum manipulation, will allow fewer recurrences.

To get earlier cases for operation we must educate the medical student in the medical school to appreciate the importance of early diagnosis and prompt radical treatment. We must educate the practitioners through the medical journals to the prevalence of cancer, so that their eyes will be open to seek an early diagnosis in cases with the slightest suspicion of cancer, or even in the prolonged troubles of many types that have not yet raised the suspicion of cancer. And we must educate the women to seek routine semiannual examinations of breasts and uterus at the hands of their accoucheurs.

To get our best results we must educate the layman to avoid persistent irritation, and the physician to keep constantly in mind the precancerous conditions and treat them so efficiently that the observable cancers never develop.

## A POSSIBLE FACTOR IN THE CAUSATION OF CANCER

## MUNITY AND IMMUNITY. DEMINERALIZED FOOD. A CANCER PARASITE

By HORACE PACKARD, M. D., Boston

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THE following theories and conclusions are the result of many years observation and study of tumor growth, both in the vegetable and animal worlds.

Laboratory investigation and experimentation have signally failed to throw much light upon the nature, causation, or mode of transmission of malignant disease. We are practically as helpless to-day in the treatment of cancer as were our forefathers of one hundred years ago; and we are face to face with the momentous fact that malignant disease is increasing at an appalling ratio.

The United States census of 1910 announced for that year 75,000 deaths from cancer, an increase of 8,000 over 1908, a rate of increase of 4,000 a year. At the present writing there are about 225,000 cases of cancer in the United States of America.

In New York State there have been 8,000 deaths from cancer in the past year. Singularly the lowest mortality rate is in the maritime districts—78 to the 100,000—while in the western districts it reaches 108 to 100,000. There were 3,000 deaths from cancer in 1891 and in 1911 there were 8,000. In the later years there has been an increase of 500 a year, which is much greater than in the earlier years.

## BRIEF CONSIDERATIONS OF CERTAIN WELL-KNOWN FACTS

1. Cancer is a disease of civilized life, and, for some reason not yet understood, it is more prevalent among the well-to-do and wealthy portion of the population.

2. Primitive people do not have cancer, or to so slight a degree that it is a negligible quantity. As far as known the American Indian, prior to the advent of the white man and civilizing influences, did not have cancer. The Eskimo still lives as he has for countless generations, uninfluenced by modern life—he is practically cancer free.

All races and tribes, upon whatsoever part of the earth's surface, who live a simple life, subsisting upon the natural products of the soil, whether of vegetable or animal origin, unmodified by civilized methods of manufacture or cooking, are practically cancer free.

3. All efforts to graft cancer from a cancer patient to another individual or to lower animals have failed, although autografting, i. e. grafting from one part of the patient's body to another is easily and successfully accomplished, therefore it may be stated that animal tissues in a normal state are immune to cancer.

Experimental grafting of cancer from one human being to another is hedged about with such strenuous ethical objections that really no reliable knowledge exists upon the subject, except that such desultory tests as have been made are all negative. Moreover, surgeons, physicians, and nurses, who in the ordinary routine of their work deal frequently and over long periods of time with cancer disease and cancer discharges, so rarely develop cancer in their own bodies that a predominating vigorous immunity must be accepted.

4. Approximately averaged, one tenth of one per cent of civilized people have cancer. For some reason as yet unknown, their resistance to cancer disease is lacking or has been lost.

5. There is some evidence that a small percentage of apparently hopeless cases of cancer, in some as yet unknown way, regain sufficient resistance to subdue the disease and recover.

The lower animals in a wild state do not have cancer, or so rarely that it is a negligible quantity and has largely escaped observation. On the other hand, animals long in captivity not infrequently develop cancer, and in domesticated animals cancer is an occasional occurrence.

The artificial propagation of trout has long been an established industry. A matter of much concern among trout breeders is the fact that such artificially bred trout develop a tumor which threatens to seriously cripple the industry.

#### THEORY

Theories are of scientific value only when they lead to or coincide with known or demonstrated facts.

The writer's conclusions, as hereafter set forth, are based upon the theory that all forms of malignant disease are possible only because of absence of or loss of immunity, and the invasion of the susceptible organism by some as yet unknown parasite

#### SPONTANEOUS RECOVERY FROM SEEMINGLY HOPELESS CANCER DISEASE

Until very recently, such an attitude of forlorn despair has existed in the minds of the medical profession regarding cancer, that anyone reporting a case of recovery from what had seemed a hopeless and inoperable condition was looked upon as a fool or a knave and the case relegated to the "error in diagnosis" class

About six years ago the writer made an effort to gather statistics of unanticipated recoveries in cancer cases which had seemed hopeless. The following are brief reports of them:

CASE 1. Patient of Dr J J Buchanan St Mary's Hospital, Pittsburgh, Pennsylvania. Sarcoma of the thyroid, pressure stenosis of trachea, tracheotomy, microscopical examination verified diagnosis. Case considered hopeless and sent home to die. Returned a year later still wearing tracheotomy tube, tumor mass smaller. Two years later the growth had entirely disappeared. Four years after the tracheotomy she died of acute pneumonia.

CASE 2. Patient of Dr W F Waugh. Recurrent carcinoma of mammary gland, dark, hard, red masses in the cicatrix at several places, accompanied by lancinating pain. Patient was seen by several other prominent physicians, who all agreed that it was a case of recurrent carcinoma of the cicatrix. She already presented the characteristic cancer cachexia and was rapidly losing strength. As a temporizing measure and with the hope of relieving pain the Faradic current was applied. Soon after this the characteristic nodes began to subside, pain ceased and the cachectic appearance gave way to a healthy color of the complexion.

Five years later she was still in good health with no local or general indications of cancer.

CASE 3. Patient of Dr E L Larkins. Carcinoma of cervix, foul discharge, bleeding, uterus fixed, patient anæmic, curettement of diseased tissue, diagnosis confirmed by microscopic examination. Six months after there were no physical local indications of disease and the general appearance of perfect health. The only after treatment was bi-weekly local treatment with ichthyol tampons.

CASE 4. Patient of Dr W H Freeman. Case of cancer of uterus, copious, offensive dark discharge, cervix eroded, uterus fixed and surrounded by exudate which filled the pelvis, cachectic, bedridden. Consultation with two surgeons resulted in diagnosis of inoperable cancer in last stage and prognosis of death within a very brief period. Microscopical examination of pieces of tissue from cervix yielded diagnosis of epithelioma. Much to Dr Freeman's surprise, marked amelioration of symptoms followed and steadily continued until at the end of two years both subjective and objective symptoms had disappeared. At the end of four years the condition of the pelvic organs, on careful examination, seemed normal and the patient's general condition indicated the best of health.

CASE 5. Reported by Dr E R Ahlman. Recurrent carcinoma of mammary gland. Some fifteen years ago one Mrs F v C was operated upon by Professor Yalmar von Bonsdorff in Iuoland, Helsingfor, for breast cancer. About a year later she returned to him with extensive cancerous growths involving the scar tissue and the surrounding thoracic wall giving a picture of *cancer en cuirasse*. He declined to operate again, considering the case hopeless. She then went to specialists in London and Paris, who likewise refused to operate. At that time she was very weak and run down showing signs of far developed cachexia. Case was given up as hopeless. Resigned to the apparently inevitable, the patient turned to the Church for consolation and preparation for death. There came, about this time, a turn for the better, the general condition improved, the recurrent nodes shrank away, and finally full recovery followed. No treatment during this time.

CASE 6. Patient of Dr Walter Wesselhoeft. Large, nodular, flattened tumor in the epigastrium reaching from under the xyphoid cartilage nearly to the umbilicus. Very tender to pressure, caused nausea and faintness, great debility, emaciation, and distress after food, very feeble and wasted. Consultation with Dr F C Shattuck of Boston resulted in the agreement that all signs were those of cancer of the stomach and that the prognosis was most unfavorable. In the succeeding months it was distinctly apparent that the tumor was diminishing in size and less tender, and that there was a corresponding improvement in general condition. Change for the better, steadily progressed, stomach received food without embarrassment, color returned, gain in weight, strength returned. At end of three months was able



to be up and about all day and enjoy life with the exception of occasional attacks of facial neuralgia.

CASE 7. Patient of Dr. I. S. Smith. Case of recurrent tumor of the right axillary region, twice operated on. Expert opinion was now sought with the advice that the tumor was malignant and amputation at the shoulder joint was necessary. The patient was unprepared for such an ordeal and begged for time to get his home affairs in shape. At this time the tumor was about the size of the fist, the patient was anæmic, had night sweats, and was generally debilitated. In the period of waiting he was placed upon a homœopathic drug treatment and rigid regulation of diet. Much to the surprise of all concerned the tumor began to abate, strength returned, night sweats disappeared, albuminuria which had been observed ceased, and his general health became normal. The tumor finally disappeared, nothing being left but a cicatrix-like ridge about the size of a goose quill.

CASE 8. Patient of Dr. C. M. Boger. Recurrent left mammary tumor, breast removed, recurrence in the scar, development of a bunch in other breast followed by axillary gland involvement. In the succeeding five years Dr. Boger was in close touch with the case and the only treatment was homœopathic medication. The tumors gradually disappeared; symptoms ceased with return to perfect health.

CASE 9. Patient of Dr. W. S. Simpson. Bunch in right breast size of egg, sharp, shooting, burning pruns. In preceding two years had been twice treated with caustic pastes. Had recently consulted three physicians in good standing, all of whom advised operation but gave no encouragement as to permanent cure. From about September, 1901, gradual improvement occurred, pain diminished, the tumor receded and finally disappeared entirely. Seven years later the patient reported the breast soft, pliable, not at all tender, as normal as any breast; scar from burning by caustic pastes remaining. The only treatment this patient received was homœopathic medication.

Gaylord of Buffalo, N. Y., and MacKay of England have also collected lists of more or less complete spontaneous recoveries of cancer cases.

#### MUNITY AND IMMUNITY

Immunity of animal life to malignant disease is evidently a very strongly implanted trait, for nearly all efforts to transplant or graft from one human being to another or from man to animal or vice versa have failed, but a significant fact which has not received due weight is that *autografting has not failed*.

This phenomenon follows the theory of a parasitic cause and loss of immunity just as it should be expected to follow.

It has been and is now a very widely accept-

ed impression among the laity that operation for cancer often results in a rapid dissemination and development in adjacent parts. The medical profession blindly combated this idea, even though over and over again the surgeon saw new nodes of cancer develop along the operation wound and in stitch hole scars. There is at the present time a tacit agreement in the medical profession that operative wounds which open into cancer tissues are likely to spread the disease and implant it in adjacent freshly wounded healthy tissue. So apparent has this become that the modern operative technique for mammary carcinoma, as well as all other forms of cancer, embraces the widest possible dissection, far from the margin of the cancer growth, and removal of the whole mass with all adjacent glands without cutting into or mutilating the diseased growth itself, lest elements of the disease become disseminated.

Since recognition of this fact of autotransplantation, and the shaping of operative technique accordingly, a greatly diminished percentage of early recurrence has been recorded.

Autotransplantation has been experimentally made by Hahn, who engrafted bits of cancer tissue from a mammary carcinoma to the skin of the arms and legs of the same patient. Carmel reported two similar successes at autografting. Several cases of incidental autotransplantation are on record.

Cripps reported a case of mammary carcinoma where the patient kept the arm bent and in contact with the cancer surface for several months. The skin of the arm near the elbow became the seat of a cancerous ulcer several inches in diameter.

A similar case of autotransplantation is reported by Morgan Williams, where contact infection occurred of an epithelioma of the inner side of the thigh to a corresponding point on the other leg.

Spread of cancer from one lip of the vulva to the other, one lip of the mouth to the other, one eyelid to the other, one vocal cord to the other, and from the tongue to adjacent parts of the cheek, have been observed. Tapping for ascites due to cancer has been followed by the development of cancer in the puncture

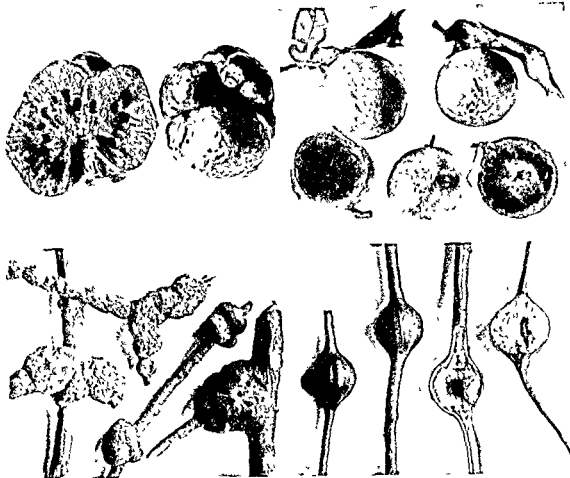


Fig 1. *Rhodites radium* *Amphilolips confluentus* *Andricus punctatus* *Trypeta solidaginis* Examples of vegetable tumors caused in every instance by the deposit upon and among the vegetable cells of an insect ovum. From photos by Miss Cora H. Clark, Boston

wound, suggesting an infecting agent in the ascitic fluid

Schimmelbach reported a case of epithelioma of the ear. The patient was in the habit of handling it. In this way he apparently transmitted it to his lip. Kaufmann reported a case of epithelioma of the hand. This was apparently transmitted to the eyelid by rubbing with diseased hand

#### THE RÔLE OF EARTH MINERALS AND SALTS IN BOTH PLANT AND ANIMAL LIFE

Plant roots appear to have the power of selecting from the soil those chemical ingredients which are necessary for their

highest development, and elaborating them and storing them away for growth and future generation

There is a vast impassable chasm between the vegetable and animal worlds, in that vegetables can select and assimilate such inorganic salts and minerals of the soil as their needs best require, while animals must be largely dependent for their food salts upon those which nature throws in their way through the medium of natural or cultivated food plants and wild or domesticated food animals

What particularly concerns us is, however, what influence upon a plant's resistance to



Fig 2 *Arceuthobium pusillum* (witches' broom). A greatly exaggerated growth on a spruce tree due to parasitic infection by the dwarf mistletoe



Fig 3 *Carcinoma quercus rubrae*. A tree cancer found in great abundance among the red oak trees of Cape Cod. Caused by the bacillus phyto-phymato

parasites results from a deficiency of earth salts in the soil. A few years ago the writer happened upon this fact. In a secluded valley in the state of Maine it came to light that apples grown upon the soil of old stony pasture land reached maturity in a much more perfect condition and freer from worms and insect pests and parasites than those grown in other parts of New England upon land which had been under long cultivation. The reason for this did not appear until later. Those old and neglected pasture lands were full of glacial boulders and deposits, and had never been cultivated because so rocky and supposedly barren. Decomposition of the glacial rocks had been going on for centuries through the process of weathering, with the result that the soil was rich in earth salts and minerals (potassium, silica, manganese, calcium, sodium, and iron).

Further study taught that in areas of the country long cultivated and overrun with plant pests and insect parasites, liberal fertilization of the soil with earth salts (potash, phosphorus, silica, manganese, calcium, and iron) augmented the quality and quantity of

plant growth and fruitage and diminished the ravages of parasites and insect pests.

Further research disclosed the following facts:

1 Food cereals, notably wheat, grown upon the long cultivated and worn out grain fields of central Europe yield a product so deficient in earth salts that millers find difficulty in milling it without adding a certain proportion of the grain rich in minerals from the wheat fields of the western portion of America.

2 The demands of civilization are for wheat flour manufactured in such a way that it will make bread which is white in color. Little or no thought has been given to the fact that the intricate process of milling takes away from the product those food salts of potassium, sodium, silica, phosphorus, lime, manganese, etc., which are absolutely necessary for strong, healthy, virile disease-resistant animal life.

3. Along the whole line of vegetable and animal food products, man is on the losing side in the matter of food salts. In all modern methods of agriculture and dairying fertiliz-

ing material rich in nitrogen but poor in earth salts is fed to plants. Dairy animals are fed upon the products of such soil and get in turn food rich in nitrogen and poor in mineral salts. The milk from these dairy animals is again rich in nitrogen but poor in food salts. The redeeming feature in the food material of domestic animals is that they receive largely the flour mill waste products (bran, shorts, and middlings) rich in earth salts, and so these may in this roundabout way finally reach the human family.

4 Commonly used methods of cooking are wantonly wasteful of these precious salts. Potatoes probably constitute the most widely used article of diet rich in food salts, next to wheat.<sup>1</sup> The prevailing method of cooking potatoes is to remove the skin, soak them in cold water for a varying length of time, and then boil until "done."

With removal of the outer skin a considerable portion of the inner skin is also removed and both thrown away. These portions are the richest parts of the potato in food salts. The subsequent soaking and cooking dissolves a part of what remains, and about one half of these precious salts are thus lost.

Rice, next to wheat, is the most widely used cereal food. In the milling process or polishing which prepares it for market all or nearly all the pericarp is removed. This is the part bearing mainly the food salts. Both human beings and animals languish and die upon a diet of polished rice.

Animal existence would be impossible without earth salts. Lime and potash in the bones and teeth, phosphorus in the nerves, iron, sodium, manganese, and potassium in the blood and muscles, are universal and ever essential elements present in healthy animals.

It must further be accepted that, incident to the cellular activity of all organic life in the death of old cells and the creation of new, there must be an unceasing excretion of these organic salts and adequate renewal supply must be available in the daily food. Upon this urinalysis is positive in the constant showing of salts of all the mineral elements of body tissue.

<sup>1</sup> Bulletin No. 43 U. S. Dept. of Agriculture

The *modus operandi* of these tissue salts is little understood but that they must be supplied for the upbuilding of animal structure, in growth and maintenance of strength, vitality, and health in mature years is beyond argument.

It is a significant fact and one not to be lightly overlooked that cancer takes its rise in epithelial and connective tissue only. In simple terms epithelial and connective tissue cells are the only elements in the animal body susceptible to cancer. What conditions of nutrition or metabolism maintain through one period of an animal's life immunity to cancer, and in another period of its life fail in immunization? Why do the skin cells of the sides of the face, the forehead, eyelids, nose and lips, of aged persons become the frequent site of epithelioma? May it not well be that in the debility of old age they fail to receive those elements or that element of nutrition which makes for epithelial cell vigor and resistance to cancer disease. It is the writer's thought that some one of the food salts commonly found in the food substances of animal life is the life giver and preserver in health and normal formation of epithelial and connective tissue cells. Which it may be of the ten or twelve salts and minerals commonly found in the animal body, we cannot say. It may be something in infinitesimal quantity which has so far wholly escaped our observation.

#### FACTS IN SUPPORT OF THE PARASITE THEORY OF CANCER<sup>1</sup>

The vegetable world teems with examples of tumor formations, and in nearly every instance a known parasite is the recognized cause.<sup>2</sup> See Figs. 1, 2, 3, 4 and 5.

The writer's thoughts were first turned to a consideration of a possible analogy between vegetable tumors and animal tumors by the chance observation during a holiday ramble that the red oak trees of the Plymouth

<sup>1</sup> The term cancer is used in this paper in its broadest sense including all forms of carcinoma and sarcoma.

<sup>2</sup> Since these cancer studies were begun some very valuable and convincing work has been done in plant tumors by Dr. Erwin T. Smith, pathologist in charge of the Laboratory of Plant Pathology of the U. S. Department of Agriculture, Washington. See *Crown Gall of Plants Its Cause and Remedy*, Bulletin 213, On Some Resemblances of Crown Gall to Cancer, Science, Feb. 2, 1912, The Structure and Development of Crown Gall, A Plant Cancer, Bulletin 255.



Fig 4

Figs 4 and 5 Examples of a vegetable tumor of bacterial origin found upon the daisy (*bacterium tumefaciens*). All these were artificially produced by inoculating with pure cultures. Fig 5 shows fifty needle stabs on two different stems, one with a sterile needle and the other with a needle dipped in a pure culture of *bacterium tumefaciens* Smith, Crown Galls of Plants U. S. Bureau of Plant Industry, Bulletin 273

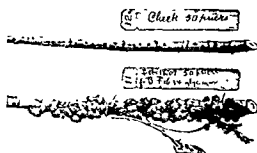


Fig 5

(Massachusetts) forests (see Fig 3) are infested by a tumor growth, analogous in general appearance, growth, metastasis, and fatality, to cancer growths of the animal world

Later, and on traveling further afield, an added stimulus to a study of this seeming analogy was afforded by the parasitic tumors found upon the lodgepole pine trees of the Yellowstone Park

In northern New England the spruce tree is the host for a vegetable parasite (see Fig. 2), the *Arceuthobium*,<sup>1</sup> which causes great localized broom-shaped overgrowths (witches' broom) that finally kill the tree. A characteristic feature is great overgrowth of the part or branch locally infected

In northern Maine the spotted alder is a common cone-bearing shrub or tree. While the cones are yet immature, a parasite invades some (not all) of the scales or segments of some of the cones, resulting in elongation and enlargement of the invaded scales to many times their original size

The ergot of rye and other grains and grasses, produced by the *claviceps purpurea*, is another well-known illustration of cell multiplication and overgrowth as a result of parasitic invasion

In fact, in the vegetable world, there is endless evidence pointing to the stimulating effect of various forms of parasitic invasion upon plant cells and the formation as a direct result of tumors (galls and burls) so similar

in their shape, mode of multiplication and sometimes fatal effects, to animal tumors, that one can but be deeply impressed with their analogy. There are plant tumors seen upon every hand, in woodland and along the wayside, and these are in every instance of parasitic origin—an insect deposits an ovum cell amongst the vegetable cells with the result now exhibited

I would like this thread of thought to run through your minds, viz, that a living potential cell has been planted among living cells of another kind. With the continuation of life of both of these parasitic cells and the host cells, there is an enormous multiplication of the host cells and tumefaction or tumor. The pathological process is identical in both plant life and animal life, and I feel warranted in announcing this influence of a potential cell upon other cells of a different kind as a law of nature, and deductions from observations upon plant pathology (see Figs. 4, 5, and 6) are quite applicable to questions in animal pathology which are hedged about with insurmountable difficulties

#### CELL MULTIPLICATION OR HYPERPLASIA A COMMON SEQUENCE OF PARASITIC INVASION OF THE VEGETABLE

The pertinent fact which confronts us as a result of this examination of vegetable parasitism is that in every instance cited there is an enormous local multiplication of cells, in other words, the primary influence of the parasite has been to stimulate the plant cells

<sup>1</sup> Dwarf mistletoe



Fig 6 Widespread infection of a group of red oaks in the Cape Cod Forest. Note the clinical similarity to Fig 7

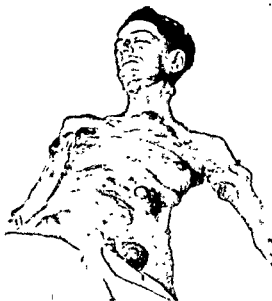


Fig 7 Author's case of multiple melanocarcinoma. Note the clinical similarity to Fig 6

to a growth which they never show under normal conditions

Turning now to the animal world do we find a known and well-demonstrated analogous state of matters?

At the very outset and in the very beginning of animal life we are confronted by the subtle and profoundly stimulating influence of one cell upon another cell of a different kind. The ovum is but a cell of infinite potentiality. The spermatocytic cell stimulates it to segmentation and multiplication beyond the contemplation of the human mind.

The blood considered as a tissue exhibits enormous multiplication of its white corpuscles under the stimulus of invasion by pathogenic bacteria.

All inflammatory tumefactions whether of staphylococcus or streptococcus origin may be accepted as analogous examples of cell multiplication as the result of the influence of other cells of a different kind.

Tubercle, gumma, leprosy, and actinomycosis are all universally known examples of tumefaction and cell multiplication from known parasitic causes.

Those tumors of the animal world which

are not of known parasitic origin such as lipomata, chondromata, adenomata, exostoses, carcinomata, and sarcomata, present, in a general way, exactly the same characteristics of cell multiplication as we have seen in the vegetable world and in some tumefactions of animal life.

The benign tumors above enumerated may be dismissed as of insufficient consequence to raise the question of their mode of origin or cause.

Of malignant tumors, however, the question of cause is a burning one and is destined to so continue until answered.

The microscope has thus far failed to show any micro organism, and laboratory investigation has not yet demonstrated a parasite which the world is ready to accept as the cause of malignant disease.

But, casting all this aside, have we not sufficient facts in the natural history of the disease and in the analogy of tumor growth in plants to tumor growth in animal life, to accept, until such time as further investigation shall positively demonstrate, the working hypothesis that all malignant growths in animal life are parasitic in their origin.

Here is a case of human cancer (Fig. 7) the initial lesion of which appeared upon the forehead. The next outcropping of the disease was upon the chest. At the time of her death scarcely any portion of the body was exempt from invasion. In the mind of the writer no theory can so well account for the initial focus of the disease and its subsequent dissemination by the way of the lymphatics as a living virile parasite.

At the present writing, a case is under observation and treatment from whom, in April, 1910, a small cutaneous tumor developing from a birthmark which microscopical analysis showed to be carcinoma, had been removed from the lower part of the anterior portion of the thigh. A few months later a similar tumor appeared in the skin near the groin; next, another growth developed in the periphery of the left mammary gland. Now there are nodes upon the back, under the arm, in the inguinal glands and in or near the cicatrices of early removal, numbering over one hundred.

In May, 1908, a young woman exhibited a movable bunch, superficially located near the lower border of the pectoralis major muscle, near the axilla. Removal and microscopical analysis announced carcinoma. Later other bunches appeared in the cervical region, in the groins, and abdomen, with subsequent extension to adjacent and distant parts.

These painful cases of local incidence of malignant disease, are so familiar to all physicians that reiteration is unnecessary.

WHAT EVIDENCE DO WE POSSESS SHOWING THAT DEPRIVATION OF ADEQUATE SUPPLY OF FOOD SALTS MAY BE A FACTOR IN THE INCREASE OF CANCER AMONG CIVILIZED PEOPLE?

#### FACTS

1. In the course of natural events upon the earth's surface there is a constant loss of those earthy salts which are essential to vegetable and animal life and health. Every river, stream, and brooklet is emptying them into the sea from which none ever return to the land.

2. The land losses are never replenished except from the slow weathering of the exposed rocks of the earth's crust.

3. The ocean is the great reservoir of the earth salts.

4. As far as is known sea life is free from any disease comparable to the cancer disease of land animals.

5. Sea life appropriates to its fullest needs all or any of the salts of the sea.

6. Those human beings whose environment necessitates subsistence exclusively or almost exclusively upon sea food are cancer free.

7. Primitive people who subsist mainly upon the flesh of wild animals and upon vegetables not at all or but slightly changed by civilized methods of manufacture and cooking, do not have cancer, or if at all in such a slight degree that it is a negligible quantity.

8. People of the lower classes who live upon a very restricted diet, bread, potatoes, and a little meat, all cooked in a primitive way with little or no wasteful loss of salts and juices, suffer less from cancer than the wealthy, whose diet embraces all edible things from all quarters of the globe and prepared according to the ultra refinements of cooking.

9. The most recent word upon the influence of the cereal organic salts comes from the Philippine Islands and the coast of Labrador.<sup>1</sup>

The almost universal method of preparing rice for market is by a process of milling to remove the outer covering or pericarp. The product is known commercially as "polished rice." Nearly all the organic salts are thus removed. Beriberi is a disease of people whose chief diet is polished rice. Change to a diet of unpolished rice prevents and cures the disease.

10. That we may free the human family from cancer by reform in dietary is perhaps too much to hope for, but as physicians and guardians of human health and life, is it not our duty, in the light of present knowledge of their potent influence for health, strength, and vital resistance, to launch a propaganda for reform in the conservation of the food salts in cereal and other vegetable foods? Cereals and potatoes enter more extensively

<sup>1</sup> Practical Experience with Beriberi and Unpolished Rice in the Philippines by Victor G. Heiser, M. D., Beriberi Caused by Fine White Flour, by John M. Little, M. D., J. Am. M. Ass. June 28, 1911; The Fight to Live in Labrador by Dr. Wilfred T. Grenfell, Boston Transcript, July 1912.

into the dietary of civilized peoples than any and all other food articles combined. The demand of the civilized world, in its ignorance, is for bread made from bolted flour—the most important food material bereft of its vitalizing elements; and in its thoughtlessness the higher classes eat of potatoes from which more than one half of the food salts have been removed by refined methods of cooking.

11. The writer begs in closing to ask the co-operation of all physicians to strive for reform in the dietary of all people so far as it relates to the conservation of the food salts. Proof of the truth of the teachings set forth in this paper must be a matter of years. If the public can be convinced that in eating of food which has been robbed of its important life-giving and health maintaining elements they are inviting cancer disease, that greatest of all levers, public sentiment, will bring about reform in methods of manufacture of food materials.

#### CONCLUDING PROPOSITIONS

In the light of present-day knowledge is the time not now ripe for full acceptance as fact that the active cause of cancer in the human family is some as yet unidentified bacterium, protozoon or fungus?

Is it not a most reasonable assumption that all animal life in a normal state of environment, and supplied with nutriment bearing all the organic ingredients necessary for the upbuilding and maintenance of a healthy resistant vitality, possesses in itself a protective immunity to cancer?

In view of the apparently well-established fact that in the vegetable world an adequate supply of the earth salts (phosphatic, potassic, feric, manganic, silicic, sodic) act as a distinct deterrent upon parasitic life and make for vigorous, virile, disease-resisting, healthy life, may we not assume as much for the animal world?

Since a critical examination of the habits of life of civilized cancer-plagued people, in comparison with the habits of primitive cancer free people shows that the main

difference is in a dietary poor in food salts of the former and a dietary rich in food salts in the latter, is it not the most logical and rational course to adopt this as the keynote to our plan of cancer treatment? It matters not whether the diet consist wholly of animal food or wholly of vegetable food. The Eskimo tribes have existed for centuries upon a dietary of uncooked animal food and are to-day a strong enduring, cancer free people. There are lower animals without number which live exclusively on the flesh of other animals and are strong, enduring, virile, and cancer free. There are wild tribes, in the as yet wild places of the earth, whose diet is wholly of vegetable products. These children of the soil are also cancer free. There are lower animals without number which live exclusively upon plant life and are strong, enduring, and cancer free.

It is far from the disposition of the writer to cast any disparagement upon the herculean laboratory work which has been done in seeking for the cause of cancer and searching for a cure. Much of great value has been learned, much more may yet be accomplished; and let us earnestly hope that the long sought for cancer antitoxin or cancer germicide may be discovered.

In the meantime may we not follow the simple teachings of Nature as we see them laid before us in the natural history of cancer disease and instruct the nations of the earth that if their peoples may hope for strong, disease-resisting bodies, bodies possessing a sufficient resistance to combat the frightful, dreaded cancer disease, a well-balanced dietary must be adopted including not only proteids, carbohydrates, and fats, but also *food salts*.

Note—Since this article was written reports have reached the writer from Drs. Walfred T. Grenfell and John M. Little who are engaged in missionary work on the Labrador coast, that the introduction of refined flour and its wide adoption as a staple article of diet by the natives has been followed by many cases of beriberi and that an increasing number of cases of a cancerous nature have been noticed this spring.



## MECKEL'S DIVERTICULUM AND COMPLICATIONS

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**T**HE presence of a Meckel's diverticulum is of a frequent enough occurrence and its pathology is so fatal that we should always bear it in mind when dealing with abdominal cases. Because of the lack of general knowledge of its presence I thought it would be worth our time to briefly review the embryology, anatomy, pathology, and surgery, and add a few cases to the literature which occurred in my practice.

**History.** Ruysch in 1701 first called attention to its presence, and Morgagni reported several cases, but John Frederick Meckel was the first to call general attention to it, and to advance a theory as to its origin and its importance as a cause of abdominal affections.

**Origin.** About the end of the third week of fetal life the primitive gut communicates with the yolk sac by the vitelline omphalomesenteric duct (yolk stalk). As the abdominal wall closes, this gradually becomes smaller and normally disappears at about the sixth month. A persistence of this duct is called Meckel's diverticulum, and in its most perfect form consists of a tube similar in structure to the small intestine, and is patent at the umbilicus forming a fecal fistula. From this perfect form there exists all grades, depending on the completeness of the developmental changes going on in the duct, in some cases consisting of a blind tube hanging free into the abdominal cavity, or attached by a fibrous band to the umbilicus, mesentery or other abdominal organs. This fibrous band or terminal ligament is the more or less atrophied remains of the omphalomesenteric artery and vein.

**Location.** It is usually stated to be in the lower one fourth of the ileum, but may be found anywhere in the intestinal tract from the pylorus to the ileo-cæcal valve. This variability can be explained along developmental lines as follows. In the earlier state the intestinal tube can be divided into three

parts: the head gut, the mid gut, and the hind gut. The mid gut becomes U-shaped, called umbilical flexure, and at its greatest convexity the vitello-intestinal duct is attached. The upper limb of the umbilical flexure develops into the jejunum and part of the ileum, and from the lower limb the remainder of the ileum, the cæcum, and the ascending colon develop. In the subsequent development a retardation of one or the other limb would cause a variance in the position of the Meckel's diverticulum, as a hindrance to the lower limb would cause the diverticulum to be close to the ileo-cæcal valve; whereas if most of the development occurred in the lower limb then the diverticulum would be located higher up, and be found in the jejunum or even the duodenum. The position on the intestinal loop is usually opposite the mesenteric attachment, but may be found on the side or even arising from between the two layers of mesentery.

**Length.** The length of the diverticulum varies, as before stated, according to the degree of involution of the omphalomesenteric duct, and may be short and blunt or very long. Lamb, in a series of 109 cases found the average length to be about two inches.

**Form.** This is usually like the finger of a glove, but may be constricted at its base or even globular and the communication with the gut closed, forming a cyst. The distal end may be clubbed or divided, or may be open and communicate with the umbilicus.

**Structure.** Like the bowel, it has its three coats: the mucosa, the muscular, and serous, as well as having the crypts of Lieberkuhn and Peyer's patches.

Meckel's diverticula have been found to be the cause of many cases of intestinal obstruction. Leichtersterm found in a series of 1134 of obstruction that 6 per cent were caused by Meckel's diverticulum. Also in the combined reports of Haven, Duchanssoy, and Brinton, in a series of 991 cases 6 per cent were due to Meckel's diverticulum.

The obstruction may be caused in many ways, of which I mention the following:

1. Obstruction from a kinking due to the traction by an attached diverticulum.

2. It may cause a volvulus of the small intestine by twisting the bowel on its long axis at the point of origin of the diverticulum.

3. A chronic inflammation of a diverticulum and adjacent parts may cause a cicatricial narrowing of the lumen of the bowel.

4. An inversion of the diverticulum into the bowel causing a mechanical obstruction, or by being drawn farther into the lumen of the bowel causing an intussusception.

5. A diverticulum which is attached may act as a band around which the bowel becomes twisted, and cause a simple constriction or a volvulus.

6. A prolapse of small intestine through an umbilical faecal fistula, or a prolapse of a Meckel's diverticulum into a hernia sac.

In reviewing the literature of the cases of Meckel's diverticulum reported, the following facts may be noted. The condition is found in about 2 per cent of the bodies. E. M. Corner of London (1), reports a case in a male child only four weeks old which was patent at the umbilicus, and from which faeces was expelled. It developed an intussusception and died. The average age of the reported cases which were operated was 15 years old. Males predominated.

**Symptoms:** The symptoms caused by a Meckel's diverticulum vary greatly, depending upon the pathology induced or accompanying it. Comparatively few come to the operating table considering that they are found in 2 per cent of the bodies. Many cause no symptoms, or the disturbance is so slight that it is overlooked. Often they have been mistaken for appendicitis or other diseases, as is shown in the various reports. The pain is usually colicky and intermittent, and located around the umbilicus, either to the right or to the left. It may be accompanied by vomiting, and is followed in a fair percentage of cases by bloody stools. The amount of blood when passed is usually copious and dark. A history of previous attacks is often given. Umbilicus often retracted. Usually no fever is present for the

first few days, and the patient's condition is very good considering the severe onset. If any obstruction is present, the usual findings are present, such as tumor, peristaltic waves, vomiting, and constipation.

In "Gray's" case, the condition was good as late as the seventh day. It is often brought on by some more violent exercise. Mayo in a series of 10,600 abdominal operations found a Meckel's diverticulum fifteen times. In ten of these it was removed to avoid later trouble, and in the other five it was the cause of the symptoms for which the patient was brought to the hospital.

A. E. Halstead (2) gives a summary of 69 cases of Meckel's diverticulum with obstruction. Fifty-seven of these were operated with a mortality of 59.1 per cent. The obstruction was caused by some form of a band, causing a constriction. H. Tyrell Gray, London (3), presents a very complete table of forty cases of invagination of Meckel's diverticulum, with various complications. Of those in which the results were mentioned the mortality was about 60 per cent. The high mortality, I believe, is due partly to the fact that the condition is not always recognized early, and in part because the pathology produced by a Meckel's diverticulum is often very extensive, as illustrated by Cases 2 and 4 which I will report.

The following cases, which have come to me in the past few years, have all been of different types and of considerable interest:

**CASE 1.** Miss L., age 28 years. Brought in by Dr. West of Batavia, May 28, 1910. History: Born in Sweden. Had the diseases of childhood. Eight years ago had the right leg amputated in Chicago for a tubercular osteomyelitis. For many years has had crampy pains in the abdomen. Never passed blood in the stools as near as she remembers. Physical examination shows, aside from an amputated limb, the patient to be in fair condition. Anæmic; heart, lungs, and kidneys negative. Umbilicus much retracted.

On opening the abdomen we found the sigmoid drawn over into the right side of the pelvis. The ovaries and uterus were small. The cæcum was high up under the liver, and in looking for the appendix we found a Meckel's diverticulum about eight inches above the ileo-cæcal valve. The diverticulum was filled with gas and faecal matter and was constricted at the bowel end so as to act as a valve. There were adhesions around it, which

were loosened, the diverticulum was removed, and the bowel opening closed by two rows of sutures. The appendix was looked for and removed, though found normal. The patient made an uneventful recovery, and reports that she has felt fine since the operation.

**CASE 2.** I. D., male, 6 years 6 months. Home in Kansas, and while visiting his grandparents in Aurora, was taken sick. Previous health good. The day before I was called, he had eaten several apples and was wrestling with other boys. Late in the afternoon he got severe cramps in the abdomen, which his mother ascribed to eating green apples, and he was given a physic. The pains continued through the night and I was called the following morning. He gave no history of ever passing blood, or having had previous attacks. Examination showed face pale and pinched, pulse 140-150 weak and thready, and temperature normal. Heart and lungs negative. Abdomen. In the region of the bladder was found a large swelling dull on percussion and moderately tender. He had passed very little urine, and by catheter very little urine was obtained. The urine was dark and contained neither sugar nor albumin. I made a diagnosis of a probable volvulus and advised operation. A consultation with Dr. Milbacher was held and advice repeated but owing to the absence of the father who was in Kansas an operation was not allowed until the following day.

The patient's condition at this time was very bad. On opening the abdomen we found the bowel black and distended. The gangrenous condition extended from the cecum up and involved a little over thirty inches of bowel. This was resected, the colon closed and a lateral anastomosis by the suture method done. The patient was in bad condition throughout the operation and died twelve hours later.

**CASE 3.** I., male, 5 years old. Patient of Dr. Scheller of Big Rock. Gives history of having had similar attacks before in which he passed blood. Present attack began with severe pain in the abdomen, lasting several hours. He was given a dose of castor oil, part of which was found in subsequent bowel movement. The following day he had another attack of severe pain lasting several hours after which his bowels did not move. On the third day he had a fecal vomiting. Dr. I. H. Lord of Plano was called in consultation. A diagnosis of an intussusception was made, and the patient brought into the hospital.

The abdomen was opened by a median incision. Twenty-five or thirty inches of small bowel were found very much dilated and covered with black patches the size of a dollar. A mass was found high up in the right upper quadrant of the abdomen which seemed incarcerated, and was brought out with difficulty. A loop of about five inches was intussuscepted and was gangrenous. This was resected. An end-to-end anastomosis was made with a Murphy button, and the abdomen closed. On examining the specimen we found a Meckel's diverticulum, which had become invaginated into

the bowel and was gangrenous. The invaginated Meckel's diverticulum no doubt caused an increased peristalsis, causing it to be drawn farther into the lumen of the bowel, producing the intussusception. On the fifth day, the patient passed the button, and left the hospital on the eleventh day. Upon recent inquiry I have learned from the mother that he has remained perfectly well. I wish to mention that the button passed unusually early.

**CASE 4.** Baby E., male, 9 months old. I will speak of this case because of a very blunt diverticulum in the lower ileum, and a very long appendix in an intussusception. The case was brought to me by Dr. F. C. Nilsson of Laurens, Iowa, April 25, 1912. Dr. Nilsson was called to see the baby on account of severe abdominal pain. A week previous it had a mild attack of pain. A few hours before the second attack the child had passed a perfectly normal bowel movement. About one and a half hours after the pain he passed about two or three ounces of blood after which frequent bloody mucus passages.

On examination Dr. Nilsson detected peristaltic waves and a sausage shaped tumor in the left side, and made a diagnosis of intussusception. He advised immediate operation and came to Aurora with the child. At the time of entering the hospital the pulse was rapid and weak, the skin which had always been of very good color, was pale, and the lips were blue. A median incision was made, which had to be extended above the umbilicus. The abdomen was filled with a serous fluid, and the tumor mass was found to be the colon, and extended across the upper part of the abdomen and down into the left side. After delivering it to the outside and finding it impossible to reduce the intussusception without tearing the bowel, we clamped it at both ends and dissected it out. The condition of the baby being very bad, we made an anastomosis by means of a Murphy button but it lived only a few hours.

Examination of the specimen showed it to consist of about three inches of the ileum, and twenty inches of colon. The appendix was about three inches long, and near it was a cupping in the intestinal wall. It was impossible to reduce the intussusception without tearing the bowel, which was found to be gangrenous for about ten inches.

The above cases have been of considerable interest to me, because of the comparative rarity of Meckel's diverticulum, and because each case has been different. In Case 1 it simulated an appendix both in symptomatology and also findings at the operation. The diverticulum contained fecal matter and gas, which is an unusual finding according to the literature that came to my notice.

In Case 2 the diverticulum caused a volvulus which resembled an extremely distended bladder. The onset was very sudden and very severe, so that even a casual inspection of the child gave one an impression of collapse. His color was bad, the expression anxious, and the pulse thready, though the pain and tenderness at the time were not much.

Case 3 was more typical of the average run of Meckel's diverticulum with intussusception. There was the severe colicky pain followed by vomiting, which became fecal on the third day. No blood, however, was passed. In this case, besides having the Meckel's diverticulum invaginated and having the bowel intussuscepted, the whole mass was incarcerated quite firmly in the right upper quadrant of the abdomen.

In Case 4, as in Case 3, we had intussusception, but involved chiefly the large bowel. The blood was passed about one and a half hours after the pain, which was no doubt due to the fact that the intussusception reached down into the descending colon, and was tightly constricted, the bowel being absolutely gangrenous.

Since reading this paper at the Fox River Medical Association I have operated on another case which I will include in the report.

CASE 5 Mr I 25 years old Brought in by Dr Thompson of Sandwich, Ill., with the following history. He had no bowel disturbances until seventeen years of age and since then has had five attacks, feeling perfectly well in the intervals. Nine months ago he had an attack with colicky pains and bloody stools which kept him in bed for two weeks. After that, he was perfectly well, and worked on the farm until three days ago, when he again had the colicky pains and bloody stools. The pains

were sudden, to the left and above the umbilicus, and felt like gas through the bowel down along the left border of the abdomen until they seemed to reach the rectum, where it felt as though they met with an obstruction and produced severe pain. The pain lasted all afternoon, and in the evening he passed a large quantity of blood. The next morning he felt perfectly well. In the afternoon he again had the pains, and in the evening passed more blood. At the time of entering the hospital he was feeling perfectly well, but was still passing dark blood in the bowel movements. He has had no stomach symptoms, no vomiting, and no tumor could be felt. Rectal examination was negative. A diagnosis of a Meckel's diverticulum was made, and operation advised, which was done the following morning.

*Operation:* A median incision was made. The Meckel's diverticulum was found about eighteen inches above the ileo-cæcal valve, attached opposite the mesentery. It was about the size of an average thumb, two inches long and very much constricted at the bowel end. It was clamped, excised, and the bowel closed by two rows of linen suture. The Meckel's diverticulum was filled with dark blood, hung free, and showed no inflammatory changes. On its surface was found a white cord-like ridge which resembled a remnant of the vitelline duct. The mucosa was very redundant, thick, white in color, fairly hard, tough and elastic like cartilage. In tracing the bowel down to the cæcum we found a Lane's kink about three inches above the ileo-cæcal valve which formed a very acute angle, with the convexity hanging downward. The Jackson's membrane which supported it was a dense fan-shaped structure about five inches at its base. This was dissected off and ligated.

The appendix was six inches long, with several fecal stones, but showed no inflammatory changes. This was removed and the abdomen closed without drain. The patient made an uneventful recovery.

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# DEPARTMENT OF TECHNIQUE

## A CASE OF EXTENSIVE SUBCUTANEOUS EMPHYSEMA FOLLOWING INTRATRACHEAL ANÆSTHESIA, WITH RECOVERY 1

By H. CLIFTON LUKE, M. D., New York City  
Anæsthetist to St Luke's Hospital

KATE S., age 36, was admitted September 14, 1912, to St Luke's Hospital, with a diagnosis of tumor of the cerebellum. Aside from symptoms immediately referable to the tumor, her general physical condition was satisfactory, the lungs being clear and the heart normal. An exploratory operation in the occipital region with a decompression was performed by Dr. Walton Martin on September 16th, with intratracheal anæsthesia.

The patient was easily anæsthetized with gas and ether (Bennett apparatus being used), and was readily intubated at first trial without apparently the slightest trauma, using a No. 24 Fr. lisle-thread catheter, and Jackson's direct vision laryngoscope. The catheter was stiffened slightly by use of cold water, as an aid to intubation. It was intended to keep the manometer pressure at 20 mm. of mercury.

It was necessary to place the patient in complete prone position, with the head strongly flexed over the end of the table, a very bad breathing position for any patient. There was considerable chance for the displacement of the catheter while the patient was being arranged in this position and draped, and in order to protect the anæsthesia in this regard, the usual close observation of the apparatus, especially the manometer was necessarily somewhat neglected for a brief time. The draping practically excluded any view of the face, and with the assistants close around the head, it was next to impossible for the anæsthetist to make any satisfactory observations. The operator agreed to watch the color of the blood for cyanosis, and a nurse was instructed to frequently observe the pulse.

The patient was quiet, of good color, and the operation was started. It was early observed that the air was not passing through the ether with the usual freedom, indicating that the intrapulmonary resistance was excessive, but the color and pulse were entirely satisfactory for the first ten minutes. During the next twenty five minutes all went fairly well except that a moderate cyanosis developed occasionally, which was relieved by extending the head a little. The pulse was now about 120, and the general condition was less satisfactory. About ten minutes later the blood in the wound was noted to be very dark, and the face, which was inspected at once, was cyanosed and generally swollen, especially on the left side. The intratracheal tube was withdrawn without a moment's delay, and the patient quickly turned to the dorsal position and artificial respiration begun. A more careful examination now showed that, aside from the face, there was also marked swelling as far down as the umbilicus, anteriorly, and to the base of the spine, posteriorly, all of which gave the characteristic crackle, on palpation, of subcutaneous emphysema.

The pulse now was 160, and the patient looked moribund, a gasping respiratory effort occurred about four to six times to the minute. After a few minutes of artificial respiration the color began to improve, and the respirations increased to ten to the minute while the breathing became Cheyne-Stokes' in type. Then, in a latero-prone position, with a very small amount of drop ether, a decompression was rapidly completed. On leaving the operating room the pulse was 140 and of better quality, the color was good, respirations were about twelve to the minute, body was rather cold and clammy, and the emphysema was unchanged.

During the next three or four days the emphysema mostly disappeared, rather rapidly from the face, but slowly and never completely from the body. There were no signs of pneumonia or bronchitis at any time, and no laryngitis or sore throat. Her condition was so satisfactory that on October 2nd (sixteen days after the first operation) an attempt was again made to locate the tumor, the decompression having but little relieved the pressure symptoms. The position was prone, and a successful anæsthesia was carried out with the use of warmed ether, vaporized into a partially closed mask, and pharyngeal tubes introduced to prevent obstruction. She died five days after this second operation of traumatic cerebritis. There were no pulmonary complications. Unfortunately an autopsy could not be obtained, but it is interesting to note that some emphysema still persisted about the base of the spine when she died.

The following possibilities may be considered in explanation of this accident.

First, that of direct trauma due to the catheter, either during introduction or afterward. Again, from pressure of the long, narrow sand bags under the neck.

Secondly, trauma brought about by overdistention. Here is considered the possibility of inserting the catheter too far, and thereby plugging tightly a bronchus, leading to overdistention and rupture of the lung. In this case perhaps obstruction was possible from the extreme flexion, and pressure of the sand bags beneath the neck. Again, the catheter may have been too large (No. 24 Fr. was used), but from experience this seems unlikely.

This is the second accident of this kind that

<sup>1</sup>Read before the New York Society of Anæsthetists, December 20, 1912

has occurred in this city during the use of this method. The other case resulted in death, and was thought to be due to the catheter slipping into a bronchus and plugging it, with consequent excessive distention and rupture of the lung.

In closing this report it is admitted that errors in technique may have been entirely responsible

for this accident; but it teaches the valuable lesson that the method is not entirely without danger, and, further, that a safety device (which was not applied to the apparatus used in either of the above cases) which will efficiently guard against high intrapulmonary pressure is absolutely essential.

## A SUGGESTION TENDING TO SIMPLIFY AND MAKE MORE ACCURATE THE CLOSURE OF THE POSTERIOR EDGES OF THE WOUND MARGIN AFTER EXCISION OF SADDLE ULCER OF THE STOMACH

By ESPY M. WILLIAMS, M. D., PATTERSON, LOUISIANA

**T**HAT the operation of gastrojejunostomy alone has no permanent effect upon ulcers situated at a distance from the pylorus is a well-accepted tenet. These ulcers should be excised. There is also a widespread movement tending towards the excision of all chronic ulcers of the stomach, wherever such excision is technically possible, owing to the recognized tendency of such ulcers to take on malignant changes.

Though uniform success has so far been attained by us in ulcer excision, the writer has frequently been put to a greater or lesser degree of trouble in saddle ulcer in closing the wound margins on the posterior wall of the stomach, depending upon the area of tissue excised. The method heretofore pursued has been that of bringing together the margins of the wound with a running suture of catgut, taking up all the layers of the stomach wall, beginning posteriorly at the lower angle of the wound and ending at the lower end of the anterior wound. Over this is then placed a continuous suture of linen, approximating the peritoneum in the usual way, beginning and ending at the same points as in the first layer. In the placing of this last suture it has been found difficult in several cases to rotate upward and forward the posterior wall of the stomach for the purpose of accurately reaching the wound margin. This should begin a little below the first layer, in order to carefully protect from leakage at this lower posterior angle especially.

In a case recently operated and in which a saddle ulcer 4 cm. from the pyloric ring was excised, the following procedure was employed with successful issue: Clamps were used, and a goodly margin of tissue allowed around the indurated area. The posterior wound lips extended well downwards, a little more than one half of the

stomach diameter being involved. With double tenaculum forceps the lower angle of the wound was held, and with a similar instrument the margins of the wound were approximated at the lesser curvature. A running lock stitch of No. 2 plain gut was now placed, beginning at the lower angle of the wound and taking up all layers of the stomach, ending at the lesser curvature, where it was tied and allowed to remain. This completed, slight upward and forward traction was made along this line of suture. Now the second suture was begun, consisting of medium weight linen, commencing slightly below the lower extremity of the ridge made by the first layer, and passing from side to side of this ridge, in continuous mattress style, from the starting point to the lesser curvature where the first layer ended. This was not tied at its upper end, but the needle passed through so as to emerge on the peritoneal surface, and the thread allowed to remain long for subsequent use. During the passing of this layer the finger of one hand was held behind the stomach as a guide. The approximation of the posterior wound margins now having been completed, the end of the catgut suture which had remained was picked up and the anterior margins brought together after the usual fashion. This in turn finished, the long end of the linen thread was used again, and the peritoneal surfaces of the anterior stomach wall were approximated by a continuous Cushing suture passed in the usual manner.

It will be seen that the usual method has been utilized throughout, except that on the posterior surface the peritoneal apposing suture passes through all of the coats of the stomach, being passed from the inner side, which greatly simplifies the placing of this layer. It has been

shown by numerous observers that while theoretically such a suture is contaminated by the contents of the viscus, practically and clinically such contamination may be disregarded, more especially when dealing with the stomach.

As far as we are able to ascertain, this method

is original with the writer. It is submitted that the introduction of the posterior peritoneal apposing suture is by this means facilitated, and by this fact that a greater surety against leakage from this part of the wound, the most troublesome to handle, is to be had.

## EXPERIENCES WITH INTRAVENOUS ANÆSTHESIA

### PRELIMINARY REPORT

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AND

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**S**URGERY of to-day has made rather exacting demands upon the anesthetist, the operator insisting upon a period of stable anesthesia of indefinite duration, with complete relaxation of the subject, minimum risk, freedom from post-anesthetic nausea and vomiting, and finally the absence of the more severe complications in the post-operative stage usually ascribed to the anesthetic. Even the layman, with an exaggerated idea of the safety of modern surgical procedures, usually disregards the potential factor in operative risks, but almost invariably raises the question of danger from the anæsthetic when about to submit to operation. These combined demands have created the "specialist in anæsthesia," whose energies in the past few years seemed to have almost exhausted the possibilities of their art as to agents and methods and in the development of apparatus, each time returning to the point whence they started in 1846—the administration of ether. Of the newer methods, rectal anæsthesia had but little to commend it and was soon disregarded. Spinal anæsthesia,—even though espoused by enthusiastic advocates in this country and demonstrated by distinguished confrères from abroad, has not been sufficiently convincing to give it a prominent place in the armamentarium of the American surgeon.

It has been pointed out by Hewitt (1) that "General anæsthesia, with its attendant unconsciousness of all of the surroundings of a surgical operation, is immeasurably preferable to local or regional anæsthesia, and it is to development in the former system, rather than in the latter, that attention should be devoted if the science is to be brought to its legitimate level." Notwith-

standing that intravenous anæsthesia has been practiced in various clinics abroad, the procedure has not appealed to our anæsthetic specialists, who probably considered it either a method of doubtful utility or the passing fad of the moment.

Experience, however, shows that this method possesses undoubted advantages, and while not in any way advocating the intravenous route as the usual method of inducing anæsthesia, its claims for use in certain cases and conditions cannot well be gainsaid. By the indirect or respiratory method of anæsthesia, volatile agents are employed which enter the blood in a volume or dosage which varies with the depth and energy of the respiratory act, with the degree of accidental spasm of the muscles concerned in the act of breathing, and the absorptive power of the bronchial mucous membrane. This method does not produce a smooth, even narcosis, as the factors utilized are subject to much variation, and the amount of anæsthetic used must always be in excess of what is actually required to produce the result in any given case.

The excess of anæsthetic is thus stored up in the body to be gradually eliminated, a process requiring some days, and not until the organism experiences some deleterious effects of the retained drug. In the employment of intravenous anæsthesia the agent is directly introduced into the blood, a minimum amount is used, it is maintained there at a certain definite percentage, and its employment can be withdrawn abruptly without storing up in the body reservoirs such excess as may subsequently prove harmful to the patient. In this method the production of anæsthesia is very rapid, the preliminary stage of excitement nearly always absent, the patient breathes almost

naturally, the color of the skin remains good, and the relaxation and flexibility of muscles are absolutely satisfactory to the operator. The degree of narcosis can be maintained to a nicety, and at the completion of the operation the patient often answers questions rationally before leaving the operating room, and returns to bed with better physical signs than before the anæsthetic was administered.

It cannot be too strongly urged that, for the successful induction of this form of anæsthesia, very careful attention must be given to what are apparently trifling details of the technique. The failure to recognize this fact was the reason of only partial success in the hands of some of our interested confrères.

For the intravenous use of ether the patient, having been prepared, is taken about forty minutes before the time for operation to the anæsthetizing room and placed preferably upon the operating table which is to be used during the operation. A subcutaneous injection of scopolamin gr. 1/100, atropin sulph. gr. 1/100, and morphin sulph. gr. 1/4 is given in one dose, in the loose tissues of the chest or abdomen. From this time until the actual anæsthesia is accomplished it is extremely advisable to keep the patient as quiet as possible, so that its administration is begun with the patient in a condition of reposeful relaxation of mind and body. This precaution materially shortens the first stage and induces prompt anæsthesia with the least amount of solution, and economy in this direction is much to be desired.

Our first experience was with ether, using the simple infusion apparatus as recommended by Burckhardt (2), the originator of the method, but subsequently in all administrations, we used the more elaborate and satisfactory technique of Rood (3). A five per cent solution of ether with filtered sterile normal saline solution at a temperature of 96° is poured into a reservoir which has a capacity of 2,000 cc. and which is adjusted on a stand eight feet above the floor level, at which point it remains during the administration. The fluid flows through an indicator (which contains a pipette), then through a warming chamber into a blunt cannula, and so into the vein. The indicator consists of a cylindrical or globular bulb of a capacity of from 2 to 4 oz., with an inside pipette, very much as used in Murphy's apparatus for protodysis. When the apparatus is working properly, the lower half of the indicator is filled with solution while the upper half contains air. The solution flows from the tank through the pipette and drops on the

surface of the fluid in the lower half of the indicator. By means of a compression tap placed below the indicator, the rate of flow can be accurately controlled, and if the fluid in the bulb is kept at a proper level a satisfactory index is furnished as to the rate at which the solution enters the vein. As ether boils at 68.6°, it is very important to keep the solution below that point, as the agent is so volatile that it usually vaporizes and escapes if the temperature is raised even for an instant above 96°.

Usually the arm furthest from the operator is selected and bound at the wrist to a padded splint, which extends under the body to the opposite side, the weight of the body holding it in place. Or the arm may be bound lightly to a splint extending from wrist to axilla and resting on a table of convenient height. This effectively prevents flexion of the forearm. The bend of the elbow is wiped with 5 per cent solution of thymol in carbon tetrachloride, which is preferable to the usual iodine application, as it is more effective as a disinfectant, and as it does not discolor the skin, the position of the vein is easily determined. After anæsthesia of the skin is induced by a 0.5 per cent solution of cocaine, the median basilic vein is exposed through a small incision one half to one third of an inch long, and a double catgut ligature passed beneath it. The distal one is tied and the ends left long and handed to an assistant, who uses it as a tractor. By lifting on both ligatures, the vein is lifted from its bed and with scissors is incised through about one half of its diameter. Into this opening in the vein a blunt cannula is introduced and tied with the proximal ligature.

The solution should be administered at a full flow at the beginning, the anæsthetist reducing the stream at the appearance of the usual signs of surgical anæsthesia. It is quite incumbent upon the anæsthetist to take the usual precautions to secure and maintain an unobstructed air way and efficient respiratory act, as with the usual method of anæsthesia. Ether is rapidly eliminated by the lungs in this method, and, as is true of all methods, efficient respiration prevents accumulation and tension in the tissues, increases its output, and lessens its toxicity. In from one to five minutes anæsthesia will be complete and the operation may proceed. Oozing is more noticeable perhaps in the operative field, and with this method, if the cavity of the abdomen is the seat of the operation, fluid rapidly accumulates there. If extensive adhesions are to be dealt with, the fluid becomes blood-stained, and there might be instances where this might embarrass the oper-



ator. But we have not been so troubled. The patient may be brought from one degree of anaesthesia to another very rapidly by the judicious use of the control indicator, and it is well that the operation be entirely finished and dressings applied before the administration, which has been continuous, is stopped, as the patient returns to consciousness very quickly.

The employment of ether in this way seems almost devoid of danger, either from immediate or remote complications, notwithstanding the fact that the infused fluid must be kept at a temperature lower than 98.6°. We have had no case of chill or fever follow 1,800 cc. administered at a temperature of 96°. This is about the only essential precaution in the intravenous administration of ether.

Having been successful in a number of cases with ether, our attention was directed to the use of hedonal in 530 cases reported by Fedoroff (4), collected from three Russian clinics. No death attributable to the anaesthetic occurred in any case, though eight cases of respiratory arrest occurred, which yielded to methods of artificial respiration.

Hedonal, or methyl-propyl-carbinol urethane, is a white crystalline solid stable powder, soluble in water at a temperature of 100°. In doses from 15 to 30 grains it has been very successfully used as a pure hypnotic. It is, to some extent, a diuretic, does not depress the action of the heart, and in lethal doses destroys life by respiratory arrest. No fatalities attributed to the use of hedonal as an hypnotic have yet been reported.

For the induction of anaesthesia, the drug is dissolved in a normal saline solution at a temperature of 70° to make a 0.75 per cent solution. The resultant fluid is filtered and brought to a boiling point, we prefer not to boil five minutes, as recommended by Page (5), as some of the efficiency is lost by volatilization of a certain amount of the compound due to prolonged boiling. The tank is filled, and when ready to begin the fluid should be about 115°. The same method as used with ether is employed, the fluid being allowed to run in rapidly. Greater caution is necessary with hedonal than with ether, the effect is much quicker, and on the appearance of signs of deep narcosis the stream is reduced until it flows guttatim from the pipette in the indicator. The patient quickly becomes drowsy, the face flushes, or, if the flow is too fast, may be slightly cyanotic, the pupils usually contract, the muscles relax, the corneal reflex is absent, and the patient seems to be in a condition of sound normal sleep without the noisy respiration of an anaesthetic. Ob-

servation of the corneal reflex determines the rate of flow, which after a little experience can be regulated to the satisfaction of operator and anaesthetist. For operations lasting from 15 minutes to one half hour the patients often wake quite promptly, but with larger administrations they may sleep six to twelve hours, during which time they may be awakened, but they readily fall asleep again. The blood pressure always falls with the use of this drug in this way, and in one of our demonstrations before the Society of New York Anaesthetists we purposely selected a case with a very high blood pressure (186 mm.), which promptly came down to 142 mm., and so remained for several days after operation. In all we have had 51 administrations without a fatality and without a complication worthy of mention, a transient diarrhoea in our very first ether case, and a slight bronchitis in a frail subject after the removal of a colloid goitre weighing nearly two pounds. The class of cases has been those that have come in ordinary general hospital service, laparotomies for uterine fibroids, pyosalpinx, ovarian cyst, appendicitis, uterine suspension; hernia, joint resections, arthroplasties, amputation of thigh, bone plating operations, plastic operations on cervix and perineum, removal of laryngeal growth, goitre, operations for varicose veins, and castration. The case of ovarian cyst was noteworthy. a woman aged 67 had been tapped 36 times. The cyst wall weighed 15 pounds, and though some of the contents was lost, ten gallons were actually measured. Ether was used in the case, the anaesthesia was a perfect success, the patient showing no untoward symptoms at the end of the operation, notwithstanding the sudden withdrawal of so much fluid, and the post-operative record was comparable to that of a minor operation.

We had one failure with ether in one of the early cases, due to allowing the temperature of the saline solution to be above the required point. One of us (Hassler) prefers ether on account of its efficacy and safety, but the other one (Honan) favors hedonal as possessing most of the characteristics necessary for this form of anaesthesia. It can be sterilized, is stable, capable of accurate dosage, prompt, efficient, reduces blood pressure, and, more important, seems to fulfill the purpose, as expressed in Dr Crile's idea of anoci-association, of preventing cerebral bombardment by shock impulses. There is no question but that the appearance of the patients after operation indicates that this contention is probably true. It has been suggested that the use of hedonal in this manner may be extremely useful in controlling



the convulsions of uræmia, particularly of the puerperal type. Its sedative action, its power to lower the blood pressure, and the diluting and eliminating effect of the saline, or preferably an isotonic glucose solution, in this instance opens up a field in speculative therapeutics that might prove of inestimable value.

We have also experimented, in two cases, with paraldehyde, but our findings do not warrant its adoption without further experience. Ether has always raised the blood pressure from 2 to 20 mm, while with hedonal it falls from 10 to 12 mm. One case, purposely selected, with a blood pressure of 186 mm, dropped to 142 mm and remained at the lower level for some hours. There have been no evidences of hæmolytic other than occurs in ordinary saline transfusion, or in the respiratory method of giving ether. Hedonal seems particularly well borne and shows no very definite

blood changes, but with paraldehyde the microscopic field shows occasional blood cells with marked crenation and pigmented spots in the cell body. In a subsequent paper this part of the subject will be particularly discussed.

The time required to produce complete anaesthesia ranged from one and one half to twenty-three minutes with ether, while with hedonal the time was from twelve seconds to four minutes. We kept one patient under ether for one hour and twenty-eight minutes, using 2,100 cc of solution (about 3 oz of ether), another with hedonal 175 grams in 1,600 cc. of solution.<sup>1</sup> No case of right heart dilation was noted, though the Trendelenburg posture was used in cases for which it is adapted. The cases were marked by absence of nausea and vomiting in every instance, comparative freedom from post-operative pain, absence of thirst, and rapid restoration of functional activities of the body. The mental status, particularly after the use of ether, is markedly clear, the patients are happy, and those who have experienced other forms of narcosis express a preference for the intravenous method of anaesthesia.

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<sup>1</sup>Since writing the above we have used a mixture of paraldehyde 25 per cent and ether 3 per cent in normal salt solution in five cases with very satisfactory results.

## Z-PLASTIC SURGERY

PLASTIC OPERATIONS TO ELONGATE CICATRICIAL CONTRACTIONS OF THE NECK, LIPS, AND EYELIDS AND ACROSS JOINTS

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IT is a difficult problem, in the surgical management of old cicatrices across joints, about the neck, or between the fingers, to liberate the deformed members and control the tissues so as to guard against a return of the same deformity after complete repair has occurred.

The usual method of severing the contracting band at right angles to the line of deformity promises little toward permanent relief of the deformity. The suggestion that an eyelet be made as a preliminary step before severing the tissue to the margin is not satisfactory. All sorts

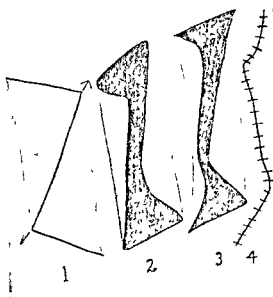


Fig 1 (1) Line of incision and shaded area showing where skin should be dissected from the other structures (2) Showing partial extension of contracted tissues (3) Showing further extension. (4) Showing complete extension and adjustment of flaps with sutures. Observe that the central part of the wound is covered with skin

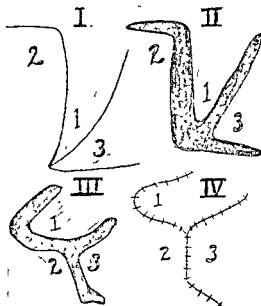


Fig 2 (1) Modified Z incision (2) and (3) Intermediate position of the flaps as they were shifted from their original to their new position (4) Completed suture



Fig 3



Fig 4



Fig 5

Fig 3 The Z-line shows the incisions. After these were made, flaps A and B were dissected loose back of the dotted lines. The second step in the operation is to take flap B and switch it over into the space left underneath the mandible on the left side, after dissecting loose flap A.

Fig 4 Flap A is drawn downward and below flap B and sutured in its new position. It will be observed that originally flap A was attached to the symphysis, but finally was sutured to the skin immediately over the sternum, and that the angle of flap B, originally attached to the skin immediately under the left angle of the mandible, was sutured to the skin immediately under the left angle of the mandible.

Fig 5 Final result. This operation was performed twenty years after the original burn. Notice, in Fig 5, there is no traction upon the angle of the mouth and that the face has assumed an entirely different expression, and that the neck line is perfect throughout the entire circumference.



Fig 9 Burn scar under the arm Operation by the Z method.



Fig 10 Result after complete repair Observe the Z-line of incision across the axillary space

of plastic operations are constantly being done, and some are successful

For bands across joints, as at the elbow, and in cicatrices of the lips, eye, neck, or fingers, the

practice is to make an incision along the crest of the band from end to end, care being taken to separate the two layers A lateral cut is made at each end of the first, but on opposite sides, back



Fig 6



Fig 7.



Fig 8

Figs 6 and 7 represent practically the same operation as shown in the preceding case, with equally good result. Fig 8 is introduced to show neck cicatrix and ectropium of the lower lip corrected by the Z operation described in the text in this chapter



Fig 12



Fig 13

Figs 12 and 13 The above pictures represent a case of web fingers following severe burns of the hand from niphtha gas. Operation performed was that described in the other cases. The little finger deformity is due to the fact that the original burn entirely destroyed the joint, and bony ankylosis resulted.

to the edge of the cicatrix. The angles of the flaps thus made are dissected back for a short distance as shown in Fig 1 (1). As the head is extended, traction is made on the skin at the end and a condition as shown in Fig 1 (2) results. With further traction a condition as shown in Fig 1 (3) is obtained. The margins of the flaps made by the longitudinal cut slide upon each other, while the end incisions are almost obliterated by the extension. The flaps are liberated as may be necessary to permit complete extension. The edges of the skin or cicatricial tissue, as it may be, are brought together and sutured as shown in Fig 1 (4). This may not be possible

near the ends, but in the center it is usually not difficult. The advantages claimed for this method of operation are:

(1) That the central part of the tissues operated upon is always covered with normal skin, or healed cicatricial tissue, and that repair takes place in the center without further contraction of the original scar.

(2) That when sufficient skin cannot be secured to cover the entire surface of the wound caused by the operation, the uncovered portions are at the ends of the scar, or at points where there is little danger of cicatricial bands reforming to produce the original deformity.



Fig 11 Showing result after operation on another case. Contractions were more extensive than in Fig 9, extending practically to the elbow. Observe the normal skin in the axillary space which was switched to this position from the chest wall.



Fig 14 Z-plastic operation of the neck for burn scar, taken sixth day after operation, before removal of stitches. Observe healthy skin in the upper flap interposed through the center of the original burn scar which destroys the continuity of scar, thus avoiding any possible mento clavicular contraction.

## THE WHITEHEAD OPERATION FOR HÆMORRHOIDS

## A REPORT OF 200 CASES

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**I**N attempting to determine the safest and best method of operating for the relief of internal hæmorrhoids, the average surgeon finds himself confronted by numerous and widely differing opinions as to the best method of performing this comparatively simple operation.

In 1882,<sup>1</sup> again in 1887,<sup>2</sup> Whitehead presented an operation which seems ideal in the light of modern surgery, affording, as it does, a means for complete removal of the diseased area with absolute preservation of the function of the parts, immediate closure of the operative wound, and permanency of cure.

The writer's excuse for presenting this operation in rather minute detail is his firm belief—after an extended use of other methods—in its superiority for the radical cure of those cases which show an almost complete circle of broad-based piles extending well above the sphincter, as well as the less marked cases involving a large part of the circumference of the rectum and also the fact that the operation seems to have fallen into disuse in the United States. This is believed to be largely due to a misconception of the technique involved, and to imaginary dangers which are not borne out by actual experience. With the exception of one article recently published,<sup>3</sup> I have been unable to find in the literature at my command any detailed description of the technique as presented in this article.

The principal objections raised to this operative method have been. (1) hæmorrhage during operation, (2) impairment of function, such as incontinence, stricture, etc., and (3) difficulty of the operation and the time required.

The results published in this paper are based on 200 consecutive cases operated on at Colon Hospital by the writer and his assistants, and covering a period of six years (January, 1906, to January, 1912). Nothing original is claimed for the technique, which, though different in some respects from that of Whitehead, is in many respects similar to that of Bloodgood and McGlennan. The cases were classified as follows: white male, 109, white female, 32, black male, 47, black female, 17. The oldest patient operated

on was 69, and the youngest 17. There were no fatalities. There was no case of serious hæmorrhage, nor were symptoms referable to loss of blood at any time observed. Two cases developed constriction at the anal orifice subsequent to operation. Both, I believe, were due to faulty performance of the operation, and both were entirely relieved by multiple incisions of the constricting scar with dilatation. One case resulted in partial incontinence, extending over a period of three months, with gradual improvement and complete restoration of function at the end of that period. No case of recurrence has come under observation, though a large majority of the cases have been seen frequently. There was no case of secondary hæmorrhage or infection. Seventeen cases with history of previous operation by other methods are included in this series. While these cases were slightly more difficult to operate than primary cases, all made good recoveries, with apparently complete cure. Comparatively speaking, the operation can be rapidly performed, no case in our series extending over 30 minutes, the average being under 25 minutes. While there is more loss of blood than with the ligature or clamp operations, there was never sufficient loss to be at all alarming, or to have any appreciable effect on the patient. Post-operative retention of urine has not been a serious factor, many patients voiding without difficulty and most of the others requiring only one catheterization. No case in the series required more than four catheterizations. Post-operative pain is slight and easily controlled.

## PREPARATION OF THE PATIENT

No food is given for at least twelve hours previous to operation. Castor oil, 1½ ounces, is administered eight hours previous to operation. An enema is not employed if free evacuation of the bowels follows the castor oil.

Ether is the anæsthetic of choice, and was employed in 174 of the cases in this series. Stovaine spinal anæsthesia (5 cc.), fourth lumbar injection, was employed in 26 cases, in which, for various reasons, ether seemed contraindicated. No ill effects were observed following the use of stovaine, and the anæsthesia and relaxation of the sphincter obtained were highly satisfactory.

<sup>1</sup> Whitehead Brit Med J, 1882, 1, pp. 118-120.

<sup>2</sup> Whitehead Brit Med J, 1887, 1, pp. 440-451.

<sup>3</sup> McGlennan Old Dominion J M & S, June, 1911.



Fig. 1

With the patient in the lithotomy position, and the buttocks drawn well down over the edge of the table, the external field is carefully shaved and scrubbed, and the sphincter dilated either with a conical dilator of the Kelly type or kneaded with the thumbs, until full dilatation is obtained. The rectum is then thoroughly flushed out with warm water. A sphincteroscope is then inserted, and through it a gauze sponge deposited well up in the rectum. The external field and the lower rectum are gone over with 60 per cent alcohol and a 5000 corrosive sublimate solution.

#### THE OPERATION

With the sphincter fully dilated and the hemorrhoidal masses in view, 7 clamps are carefully placed around the entire circumference of the bowel at the mucocutaneous junction (Fig. 1). Care must be taken to grasp only the barest edge of skin. With the left forefinger in the rectum, as a guide, an incision is then made through the skin around the entire circle, keeping closely against the upper edge of the clamps. When this preliminary incision has been completed, traction is made on the clamps and with free strokes of the scalpel the sphincter is exposed (Fig. 2). If the forefinger is used as a guide and care be taken that the strokes of the scalpel are made at right angles to the guiding finger and close to the retracting skin margin, a very rapid exposure of the entire circumference of the sphincter can be obtained, with little or no hemorrhage or tearing of the tissues. The lowest attachment of the muscle to the bowel is then freed with a few strokes of the scalpel and the muscle rapidly rolled back, using the side of the scalpel blade or handle, until the hemorrhoidal area is passed. The clamps should now be reset,



Fig. 2

close together, around the entire circle, grasping normal tissue just above the hemorrhoidal area. Care should be taken that the dissection has been sufficiently complete to allow that portion of the bowel at the upper edge of the reset clamps to be brought to the skin margin free of any tension, and that no portion of the muscle is in the grasp of the clamps. The whole field is then flooded with hot normal saline solution until all oozing has ceased. An incision is now made in the long axis of the bowel (Fig. 3) extending to just above the line of the clamps, and the first suture is taken from skin through mucous membrane at its apex. The line of sutures is continued around the circumference of the anus by cutting along the clamp line a small section at a time, (Fig. 4) each section being carefully sutured at cut. The operation is completed with the removal of the rectal sponge, flushing off the suture line with normal saline solution, and the insertion of a gauze wrapped rubber tube, about  $\frac{1}{4}$  inch in diameter, thickly coated with iodoform ointment. No tension sutures are employed, the necessity for these being overcome by a dissection extending high enough to make an easy approximation of the parts, absolutely free of tension. Ligation of bleeding vessels is rarely, if ever, necessary. The only bleeding of importance usually encountered is from the vessels in the walls of the rectum proper. By putting a slight lateral tension on each small section as cut, and introducing the sutures at a very slight angle to the long axis of the bowel, the bleeding in these vessels is easily controlled by the sutures alone. Interrupted sutures are employed, the number varying from 18 to 30. Any fine non-absorbable suture material can be used. We have found Pagenstecher yarn by far the most satisfactory.



Fig 3

An accurate approximation of gut to skin is essential to the success of the operation, and special care should be taken that there is no puckering of skin or bowel in any way decreasing the size of the anal outlet. Ordinarily, good surgical technique — a careful dissection carried sufficiently high to allow normal gut to be brought to the skin line without tension, the use of many interrupted sutures, with careful approximation of the tissues, bearing in mind always the fact that the anal orifice should easily admit two fingers without tension on the suture line — will, I believe, give uniformly good results with no fear of stricture, hæmorrhage or infection.

#### POST-OPERATIVE TREATMENT

The rectal tube is removed in 24 hours. Iodoform ointment is applied two or three times a

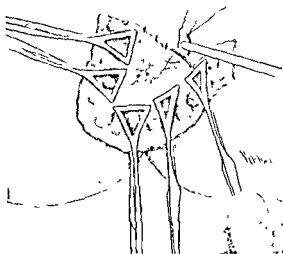


Fig 4

day for three days. On the fourth day a dose of castor oil sufficiently large to obtain a free evacuation is given. The operative field is flushed off after each defecation, up to the fifth day. The sutures are allowed to separate and come away without interference. This is usually accomplished within ten to twelve days. The patient is allowed to leave his bed on the fourth day and can usually be discharged from hospital by the seventh day.

I wish to express my thanks to Colonel W. C. Gorgas, Chief Sanitary Officer, Isthmian Canal Commission, for permission to publish this paper, and to Surgeon Wm. H. Bell, United States Navy, and Superintendent of Colon Hospital, for his kindness in preparing the accompanying drawings.



## THE CURE OF PROCIDENTIA UTERI IN ELDERLY WOMEN

## A NEW INTRA-ABDOMINAL TECHNIQUE

BY FRED FLETCHER, M. D., COLUMBUS, OHIO

Surgeon to Grant Hospital

THE discussion accorded uterovaginal prolapse at the last meeting of the American Medical Association (1), convinces one that there has been no general agreement among surgeons as to the best method of operating. Practically 100 per cent of the cases operated upon by amateur surgeons recur, and patients who have been operated upon according to certain recognized principles by competent men, not infrequently return complaining of discomfort from cystocele.

The Kocher (6) Crile (7) Eastman (8) and Mayo (9) are recognized abdominal operations for the cure of procidentia.

The Watkins-Wertheim, Goffe (2), Hirst (3), and Dudley methods are cited as the most satisfactory vaginal operations. The Wertheim technique supports the bladder by interposing the uterus—turning it upside down. An incision is made through the anterior vaginal wall; the bladder is freed, the peritoneum opened, and the fundus of the uterus pulled forward between the bladder and vagina and sutured. The operation is completed by amputating the cervix and repairing the posterior vaginal wall. The technique is not

difficult, and the dangers of injuring the bladder are minimized if the surgeon bears in mind that the blue veins, easily seen in making the gauze dissection, rest immediately upon the bladder. The Wertheim procedure has the advantage of conservatism, and meets the requirement of those who argue that an abdominal incision adds an unnecessary element of risk to a class of patients normally obese.

Baldy, of Philadelphia, in a recent article (4), described a new technique for the cure of procidentia. The intra-abdominal features of his operation (except the cervical fixation) have for years been practiced as a routine at the Grant Hospital in the making of supravaginal hysterectomies. Personally, I have used the procedure described by Baldy, and discarded it only when convinced that the operation to be detailed later gave better end results. The point made with regard to the attachment of the cervix stump close to the pubic bone is the important feature of the Baldy technique, and obtains in the operation which I practice.

The following procedures have been used by me for the past four years, and the results which

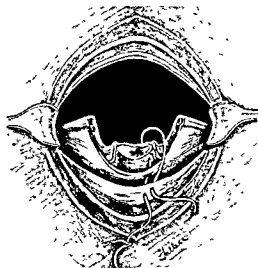


Fig. 1

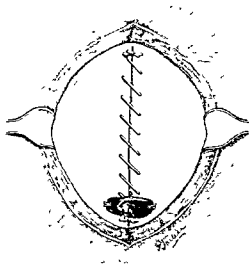


Fig. 2

I have obtained in a considerable number of cases justify this report. There are certain features of the intra-abdominal work which, to my knowledge, have not been recorded.

The operation is essentially an abdominal hysterectomy, the uterus being amputated at the internal os, and the stumps of the broad ligaments, together with the round ligaments, being utilized (according to the Gilliam principles of suspension) as a secure means of supporting the cervix stump and bladder close to the pubic bone. The abdominal operation is preceded by the following plastic operations on cervix and vagina:

**Amputation of cervix** The usual high amputation is made, thoroughly removing the mucous membrane from the cervical canal, and closing the stump with four deep sutures of No. 3 chromic gut.

**Anterior colporrhaphy** An oval denudation is made, extending to within one half inch of the urethral orifice, over the most prominent part of the cystocele. It is important to conserve the fascial layers, stripping them by gauze dissection from the vaginal membrane. The bladder is thoroughly freed and the defect closed with a purse-string suture of No. 3 chromic gut.

**Perineorrhaphy** The relaxed posterior vaginal wall is resected in a rectangular manner, widely exposing the rectocele and retracted levator ani muscles in the lateral sulci. The defect is closed by means of a Waldo figure-of-eight stitch, using No. 4 chromic gut (5). Before tying the stitch, a suture is passed through the levator ani muscles so that when tied they form a bridge across the rectocele and push it back in hourglass fashion. The Waldo stitch is tied by pulling in a seesaw manner.

#### ABDOMINAL TECHNIQUE

The abdomen is opened through a short suprapubic incision which splits the inner border of the right rectus muscle. A supravaginal hysterectomy is made, severing the broad ligaments flush with the uterus, and dividing the cervix at the internal os. The cervical canal is touched with iodine. The ovarian and uterine arteries are ligated. The tubes and ovaries are removed with the least possible destruction of the broad ligaments. It is a curious fact that the procidentia cases are usually clean, the body of the uterus being small, the tubes and ovaries normal in appearance and the ligaments relaxed. The heavy part of the uterus is the vaginal segment.

The fat on either side of the incision is freed from the abdominal aponeurosis, and a one-half-inch cut is made through the aponeurosis at the outer border of the rectus muscle. A pointed

hæmostat is introduced through this cut in such a manner as to separate the muscle fibers and bulge the peritoneum, the latter being opened with a pair of curved scissors. The stump of the broad ligament is now grasped with the hæmostat and pulled through the opening made in the abdominal wall, exactly as in the Gilliam method of suspension for retroversion.

When the broad ligament stumps have been delivered through the abdominal wall they are drawn taut so as to pull the cervix stump in the lower angle of the incision immediately above the pubic bone. Fixation of the cervix stump is comparatively easy. A curved needle (carrying No. 1 chromic gut) catches the muscle and peritoneum, to the side, at the lower angle of the abdominal incision, passes through the posterior layer of the broad ligament, then through the side of the cervix stump, and out through the anterior leaf of the broad ligament, returning to the starting place. The suture is not tied until the same procedure is practiced on the opposite side. The tying of these sutures fixes the raw surface of the cervix stump to the peritoneum and approximates the two layers of the broad ligaments, which are always separated at the point where the uterus is amputated (Fig. 1).

The abdominal wall is closed in the usual layer fashion, using No. 2 chromic gut for the aponeurosis. The broad ligament stumps and the redundant round ligament form broad serous flaps which are overlapped and sutured above the aponeurosis in the manner shown in Fig. 2.

Aside from the benefit which results from plastic work in the vagina, the intra-abdominal procedure accomplishes what Baldy points out for his technique (4), namely, (1) The weight of the heavy uterus is removed, (2) the over-stretched vagina is lifted high and held firmly in place, (3) the supports utilized are natural supports of the uterus and vagina—the broad ligaments, (4) the cervix remains a pelvic organ, as is natural, and (5) the immediate and remote results, as regards fixation of the upper part of the vagina, are perfect.

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## HOW TO SECURE THE END OF A SUBCUTICULAR SUTURE

By FRANCIS REDER, M. D., St. Louis

THE subcuticular suture as given to us by Halsted is a splendid suture. In certain parts of the body, such as the face and neck, it is not only admirably adapted, but it is the suture of choice.

When properly applied it leaves a scar that in the course of several months becomes almost invisible. The suture has not found the favor with surgeons that it should. Why? It is true its method of application requires some special practice. In surgical work that is not at all strange. The polish of a finished surgeon is the result of work that comes after years of close application. It is immaterial whether or not the surgeon uses a large straight needle or a small curved needle (that is a fancy which rests with his deftness) in penetrating the proper stratum of the skin that a classic wound closure may be obtained, it is material with him, however, how to best secure the end of the suture after having united the skin margins.

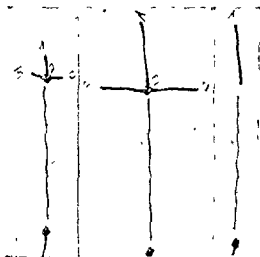
In my observations of the work of different surgeons working with the subcuticular suture, this very point seems to be a stumbling-block. It appears to me that here lies, to a great extent, the cause for the limited usage of this efficient suture.

Some surgeons, after having finished the subcuticular stitch, secure the end by simply piercing the skin with the needle armed with the catgut two or three times a short distance away from the angle of the wound, in that way anchoring the suture end. Others pierce the skin near the angle of the wound and tie a knot by looping one side of the suture. Such a procedure is not in accord with the idea of a subcuticular suture. It defeats its object and mars its beauty. There is no necessity for it and the scarring it causes, mild as it may be, is uncalled for.

I have for a number of years, whenever the subcuticular suture was employed, secured the end in this manner:

The suture is started by having the end of the catgut strand well knotted so as to form a good point of resistance to the skin. The skin margins are brought and held in apposition by the stitch best suited to the operator's skill.

When the opposite angle is reached, in order to secure the suture, the needle is passed under the skin in line with the axis of the closed wound and



the catgut strand pulled through the skin about one-fourth of an inch from the angle of the wound. The protruding end should be two to three inches long at least. A separate piece of the same catgut strand about four inches long (long enough to be conveniently handled) is tied about its middle to the protruding strand "A" at its base "D". A simple and single knot is all that is necessary. We will designate, for the sake of a clearer understanding, the ends of this strand "B" and "C". Next strands "A," "B" and "C" are tied together at "D" in a firm knot, large enough to offer the proper skin resistance. This knot will be effective in securing the suture without any additional trauma to the skin.

The strands "A," "B" and "C" are cut short. It may be stated that the correct application of a subcuticular suture can be very satisfactorily executed with numbers 0, 1, or 2 plain sterile catgut. Good flexibility and pliability of the catgut is a qualification which is of considerable technical importance.

For the past four months we have stored the gut in McDonald's acetone-alcohol-glycerine solution (Am J Surg, May, 1910), with results superior to those obtained when stored in plain alcohol. This solution renders the gut smoother and stronger without decreasing its elasticity and pliability.

OBSTETRICAL AND SURGICAL TREATMENT OF PUERPERAL ECLAMPSIA<sup>1</sup>

BY JOHN F. MORAN, M. D., WASHINGTON, D. C.

**E**CLAMPSIA is the gravest complication in obstetrics, grave because of its unknown etiology, grave because of its known pathology, showing the presence of a highly irritating toxin in the circulation, and grave because of its often sad result, the loss of both mother and child.

Upon whatever theoretic basis we may predicate the etiology of eclampsia, whether of foetal, maternal, or combined origin, the one incontrovertible fact is that pregnancy at least is necessary, for without pregnancy there can be no eclampsia. Therefore, the therapeutic conclusion must be that in eclampsia prompt termination of the pregnancy, through the quickest possible delivery consistent with safety, is of primary importance. It is quite possible that the eclamptic may withstand the attacks without immediate delivery, and the birth may terminate safely. It is nevertheless true that many women succumb who are left to expel the child unassisted. Therefore the prognosis is much more favorable in a prompt delivery than in one that has been delayed.

How the termination of the pregnancy shall be effected must be governed by the condition of the cervix, frequency of the convulsions, and depth of the coma. If the cervix is already dilated and there is no longer any contraindication to the use of forceps or version, rapid delivery is easily accomplished. Such cases occurring late in the stage of dilation have, as is well known, a relatively favorable prognosis. It is less promising when the convulsions appear before the cervix is sufficiently dilated. If the cervix is effaced but the external os remains undilated, metal or manual dilatation may suffice to effect quick delivery. If time is not a necessary factor, in multiparae with old lacerations of the cervix, instrumental or manual dilatation might be hazardous, therefore in these cases rubber bags can be employed. The author recalls one such case in which an old tear of the cervix being felt to give way during manual dilatation, the method was promptly abandoned and a Voorhees bag substituted with success.

When the cervical canal is rigid and not unfolded, metal and manual dilatation, or, more correctly speaking, *dilatation*, of the cervix

aggravates the eclamptic seizures and causes shock, deep cervical tears are not infrequent, and hæmorrhage and infection often complicate the situation. Therefore, we have in cases of intact cervixes with menacing signs the operations of vaginal hysterotomy and abdominal Cæsarean section at our command. The former is indicated in cases occurring before the eighth month and the latter after that time.

Like many other innovations, vaginal Cæsarean section has been vehemently opposed as being an irrational and hazardous procedure, and even stigmatized as the prostitution of surgery, yet, in spite of the opposition, it is steadily growing in favor and is considered by many as the most important addition to obstetric technique in modern times.

Peterson<sup>2</sup> has collected 530 cases of eclampsia in which vaginal Cæsarean section was performed, with 124 deaths, or a mortality of 23 per cent. In this connection it might be stated that general statistics are not always infallible as to the merits of a measure in any particular case, depending as they do upon the environment, and the judgment and skill of many operators. Rather should we judge the measure and its possibilities from the results obtained by individual operators. For instance, in 33 cases of vaginal Cæsarean section for eclampsia, Veite had only one death, and Bunn had only one death in 40 consecutive cases. The operation has been performed 26 times in this city, by 5 operators, with 2 deaths, or less than 8 per cent.

The author<sup>3</sup> recently reported four cases of classical Cæsarean section for eclampsia successfully operated upon four or more times in this city; three times in one case by Dr. W. P. Carr and one case by Dr. Stone. All the children were delivered alive and three are still living. In reviewing the literature the author collected 116 cases, with a maternal mortality of 48.93 per cent and infant mortality of 39 per cent. At first glance this is not a convincing argument in favor of this method of intervention in eclampsia, but the final analysis shows that a very large percentage of the patients had been previously subjected to other methods of treatment, and many were practically

<sup>1</sup> *Am. J. Obst. & Diseases Women & Children*, 1911, lxxv, 1.

<sup>2</sup> *Southern Surgical and Gynecological Transactions*, 1912.

<sup>3</sup> Read in a Symposium on Eclampsia before the Medical Society of Georgetown University, November 9, 1913.

moribund before the operation was resorted to. If we compare the series of 53 cases from 1901, collected by myself, with the previous ones, we find that the death rate for the mothers has been reduced to 32.32 per cent and for the infant, 19.9 per cent. This steady improvement in the statistics has been due in a great measure to better technique, greater care in the selection of the cases, and prompt intervention.

Certainly with the knowledge gained and with wider experience, it is reasonable to expect that the mortality will, in appropriate cases, by the elective classical and vaginal Cæsarean section be still further reduced.

Lumbar narcosis has been practiced in eclampsia, but without success, likewise lumbar puncture, with subsequent aspirating of the cerebrospinal fluid.

Zangmeister<sup>1</sup> believes that eclampsia is a kind of reflex epilepsy and is the result of pressure from oedema of the brain, which is enormously increased during the strain of each labor pain and which he claims may be relieved by reducing the pressure through the agency of prompt trephining. Zangmeister had the courage of his convictions, and actually did the operation in three severe cases of eclampsia persisting after delivery, two of which patients recovered and the third died on the sixth day, although the eclampsia had long subsided. In the latter case the dura had been sutured again after the operation and it is possible that the oedema recurred. Kosmak says this must be regarded as rather an extreme form of treatment, and may be classed with that which depends on a complete amputation of the breasts for the subsidence of the convulsions.

As to whether Diebuhl's operation of decapsulation of the kidneys will extend its sphere of usefulness to eclampsia, it is not possible to form any definite conclusion from the available data. Of the ten cases on record, the decapsulation was followed by rapid recovery of six of the patients, in two cases no benefit was manifest, and in the remaining two improvement was probable, but not pronounced. In eight cases the women had been delivered before the operation, including one of the cases in which no influence was apparent from the operation. In the other cases the operation had been done before the evacuation of the uterus, the results being successful in only one of them.

Venesection is so seldom practiced nowadays in the treatment of eclampsia as to be almost regarded as a lost art, and yet in suitable cases

it is one of the most valuable measures at our command in combating eclampsia. Where the blood pressure is high, with cyanosis, rapidly recurring convulsions, deepening coma, and threatened oedema of the lungs, it is particularly serviceable. Its beneficent effect was strikingly shown, where those indications were present, in a post-partal case seen recently in consultation with Dr Wilson, and the author is thoroughly convinced that the blood letting was the principal means of saving the patient.

The author wishes to say a word of caution regarding anaesthesia. Chloroform, almost since its discovery, has been considered as one of the sheet anchor remedies in eclampsia. An unfortunate experience in the loss of a case from late chloroform poisoning has taught me that it is an exceedingly dangerous remedy and that its value has been greatly overrated. Recent investigations have demonstrated that it produces lesions of the liver and other organs similar to those of eclampsia. Given at the time of the convulsion, when there is a tendency to asphyxiation, it increases the difficulty by interfering with the supply of oxygen, and, furthermore, it is a cardiac depressant. The author has for these reasons abandoned its use in obstetrical cases, and restricts the administration of the anaesthetic until the time of intervention, and gives ether.

Dr Foote informs me that the two fatal local cases after vaginal Cæsarean section had received nitrous oxide anaesthesia. Since that time investigation by himself and Hamilton shows that the ammonia coefficient is increased in some cases with resulting acidosis, so, like chloroform, its use in eclampsia is contraindicated.

Of course, synchronously with the obstetrical or surgical termination of the pregnancy, eliminants and sedatives are to be employed, because the combined treatment yields the best results.

It must be borne in mind that we have as yet no specific treatment for eclampsia, and the method of intervention must be adapted to the exigencies of the individual case. In the presence of the severe types we are well nigh hopeless. The graver forms comprise from 3 to 5 per cent of the cases in general, they are more frequent at different periods, and they may appear in groups. Such was our experience at Columbia Hospital. After having obtained for several years quite successful results, that is to say with a mortality of 10 to 15 per cent, these were followed by a series of cases in which the previously approved treatment absolutely failed, the mortality reaching 70 per cent. These malignant cases are frequently attended with few convulsions, coma quickly

<sup>1</sup> Quoted from Kosmak, *Am. J. Obst. & Diseases Women & Children* 1915 lxx 5

supervening after the first seizure, accompanied by fever, jaundice, hæmoglobinuria, or suppression of urine, and they are rapidly fatal.

In conclusion, while the etiology of eclampsia is still unsolved, its clinical phenomena and pathology point to a probable intoxication of foetal, maternal, or combined origin. Therefore, evacuation of the uterus, elimination, and sedation are the chief indications in the treatment. The sedatives are valuable for their tranquillizing influence while delivery is being promoted or effected by other direct measures. The result in a given case will depend upon the severity of the attack, the judgment and skill of the physician, and the rigid observance of asepsis. Essential to success is a well-thought-out plan of prompt but not overzealous procedure, based upon the various phases of the disease, combined with a knowledge of the condition of the cervix and the changes it must undergo before pregnancy can terminate or be terminated.

The author wishes to supplement this conclusion with the following "Don'ts".

Don't delay terminating the pregnancy after the onset of the first convulsion. The earlier the uterus is evacuated, the lower the maternal and foetal mortality.

Don't treat the patient haphazardly, as the

mortality and morbidity are exceedingly high under such conditions. Endeavor to choose the right method of operation in the first instance.

Don't give chloroform or nitrous oxide, as they both cause acidosis. Ether, while not free from objection, is the least harmful, but its administration should be restricted to the time of intervention.

Don't forcibly dilate an intact or rigid cervix. It is irrational and unjustifiable. Bear in mind the physiological and anatomical changes necessary to soften and unfold the cervix, and dilate the external os. The divulsion of the cervix in a few minutes by instrumental or manual methods — what Nature takes, under normal conditions, hours to do to preserve the integrity of the soft parts — is unscientific, dangerous, and brutal. It is in this class of cases that the cutting operations, when done primarily, give such excellent results. Vaginal hysterotomy is the operation of election up to the eighth month, and the abdominal Cesarean section after that time, particularly when the child is of average size or has a weak foetal heart beat, in cases of corpulency or when the cervix is high, in posterior positions.

If these "don'ts" be universally observed we will see a great reduction in the mortality and morbidity of eclampsia.

## DILATATION OF TIGHT URETHRAL STRICTURES CAUSING RETENTION

By W. S. SCHLEY, M. D., NEW YORK CITY

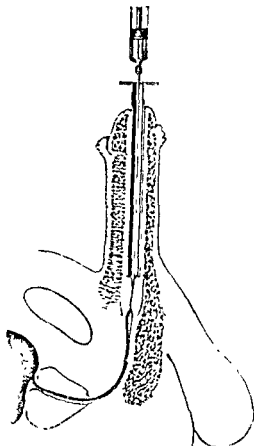
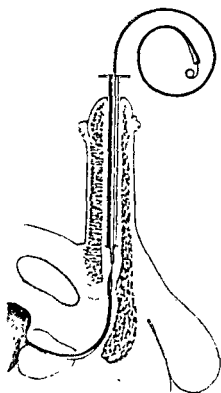
**O**CCASIONALLY, even with the aid of the endoscope it is impossible to pass a filiform through a tight urethral stricture which is causing retention, or, if not impossible, at least it is accomplished only after the expenditure of considerable time and labor and with the danger of urethral laceration. The injection of oil and the use of cocaine and adrenalin in the urethra are of great service, but they must come in direct contact with the strictured area.

The following method I employed for the first time nearly seven years ago, and with its aid some of the difficult strictures of the urethra may be passed and subsequently dilated without urethrotomy, external or internal. It has served extremely well in those strictures far enough forward to be instrumented with accuracy from the meatus.

An endoscope is passed to the site of the

stricture, developing its orifice. A blunt pointed round end needle of hypodermic type and 17 or 18 Brown & Sharpe gauge diameter is pressed against or as far in the orifice as extremely gentle pressure will allow, and a few drops of cocaine-adrenalin mixture introduced. In a few minutes it is usually possible to insert the needle very appreciably farther in. After it has entered 4 or 5 mm., a No. 5 F. woven urethral catheter with taper end is substituted and injections made through this, advancing after each injection. The catheter is smooth, sufficiently flexible, especially the tip, and takes the irregularities in the stricture well. Ten or fifteen drops of the solution are usually sufficient. The case below is illustrative.

E. R., April 28, 1906. A man of 50 years of age had had a stricture of the urethra for over 15 years. He presented himself, with complete retention, having been unable to



void urine since forcing out a few drops in the early morning some hours before. Filiforms failed to pass. The endoscope showed a tight stricture beginning just below the penoscrotal junction. By moderate pressure on the instrument the orifice was developed more clearly as the mucosa was stretched from the center, but it was impossible to more than barely enter a filiform. A long medium fine blunt end needle entered 2 or 3 mm and a few drops of equal parts 1-1000 adrenalin and 4 per cent cocaine solution were injected. After the needle had passed about 5 mm the urethral catheter was used, and in a total of fifteen minutes' work it had passed to the bladder. The stricture proved to be of 3 cm length. The following day it was more difficult to insert the catheter, and I regretted not having left a filiform in place. There was undoubtedly engorgement following the anemia produced and the mechanical insult. On the third day, however, it was possible to pass a No. 8 F elastic bougie and a week later a No. 10 F. From that time on the dilatation was simple. Three months later a No. 25 F. sound passed smoothly.

After the first dilatation it is well to leave a filiform in the urethra if urethrotomy is not done. The latter operation may be done with the Maisonneuve or any of its modifications with or without an external urethrotomy if preferred, or an external urethrotomy done with the filiform as a guide, or the stricture reserved for dilatation later.

It is not the intention of this paper to go into the relative merits of dilatation or urethrotomy for these cases or retrograde passage of stricture, perineal or suprapubic, but to suggest a method of passing some of the difficult ones for the relief of retention or for a guide for urethrotomy.

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD NOVEMBER 3, 1911, THE PRESIDENT, DR. FREDERIC A. BESLEY,  
IN THE CHAIR

DR. E. C. RIEBEL read a paper entitled, "Rupture of the Diaphragm, and Positive Pressure (Meltzer's Insufflation)" See p 133.

### DISCUSSION

DR. H. M. RICHTER: Dr. Riebel, in his paper, opens up a number of phases of thoracic surgery for discussion. First, what class of cases require the use of a device for maintaining respiration, second, what apparatus should be used, and, third, which of the various types of artificial respiration should be used.

First, as to what cases require the artificial methods of maintaining respiration in thoracic surgery? For our purpose, we may consider the chest made up of two compartments, separated by a complete diaphragm, and each section capable of functioning independently of the other, either one functioning without the other and capable of maintaining life. Therefore, if the injury or the disease is such that one side of the chest only is interfered with, it would seem to me we immediately do away with all need of any type of artificial respiration. For instance, we may safely open one side of the chest for any purpose whatever, opening it through the diaphragm or through the chest wall would, of course, be equivalent. A rupture of the diaphragm, resulting in a hollow viscus of the abdomen passing up into the chest cavity, may be handled either by increasing the intrathoracic tension by any positive pressure device in use, or, more simply, by making an incision between two ribs and allowing air to enter the chest in that way. If in such a case of rupture of the diaphragm on one side the incision were made between two ribs, it would be difficult to maintain the abdominal viscera in the chest. They tend to slide back into the abdomen in the same way as in ordinary laparotomies. An incision made through the abdominal wall in a patient who is completely relaxed would not tend to allow the hollow viscera to escape through the abdominal incision. With

the patient relaxed the viscera would remain within the abdomen.

Taking it for granted that we have occasion to use some method of artificial respiration and of maintaining life by it, then there are three types of apparatus to be considered in making our choice. the type of so called negative pressure apparatus devised by Sauerbrück, the various positive pressure types of apparatus, all of which work practically on the same principle, and thirdly, the method of Meltzer. If life can be maintained by getting air within the lung without making any respiratory movements, if the external respiratory movements are not essential to life, if their only object is to get air within the lungs, then it seems to me, the Meltzer apparatus is the ideal apparatus, because by passing a tube down the trachea to near the bifurcation and passing a continuous current of air through it we can obtain air in the lung where we want it. As a matter of fact, that has been done.

I saw some of Dr. Riebel's work, and I have personally used Meltzer's method, and there is no doubt at all but what it is a successful method. The so-called positive and negative pressure methods of maintaining artificial respiration are based upon the same mechanical principle, the positive pressure devices are simpler, Meltzer's method should displace both to a great extent.

The device of which I published a description a couple of years ago was a comparatively simple one for maintaining the lungs in distention and maintaining artificial respiration, but the Meltzer device has rendered it to a great extent unnecessary. If we need some method of maintaining respiration and of getting air into the lungs, the Meltzer method would appear to be the method to use.

Dr. Riebel spoke of using from forty to sixty millimeters of mercury with the Meltzer apparatus, and I think he meant with the chest opened. The tension within the lungs may be raised to a



great height, provided the chest is closed. A man in playing such an instrument as a horn can raise the tension within his chest to a considerable height. A man descending beneath the surface of the water raises the tension fifteen pounds for every thirty-two feet he descends. But the lungs will not stand a tension of more than ten or fifteen millimeters of mercury with the chest opened, because the lungs are so delicate that with that amount of tension, without protection of the chest wall, they would balloon up indefinitely. A pressure of six or eight millimeters within the lung with the chest opened will maintain the lungs in the ordinary sized dog at the normal physiological extent of distention. A pressure of ten to twelve millimeters of mercury will blow the lungs out of the chest. We are making an error in our deductions from experimental work on dogs, in that we are forgetting that the dog's chest for experimental purposes is practically a single cavity instead of a double cavity. The dog's mediastinal septum is so thin and movable that, if we open one side of the chest wall, it practically allows collapse of both lungs. That does not apply to human beings, except to young infants.

DR ARTHUR DEAN BEVAN: Dr Richter's discussion is a very able one and particularly valuable, because he has done a good deal of work along this line, and I think the conclusions he has arrived at are absolutely correct. You all know that a lot of money has been spent in connection with this work. For example, one New York surgeon has had a special operating room constructed at the expense of many thousands of dollars, and then when Meltzer introduced his simple apparatus, this surgeon naturally criticised the simple Meltzer apparatus because he had already spent some twenty-five thousand dollars for installing an elaborate apparatus which meant that amount of money thrown away if Meltzer's apparatus was as efficient. There has been a whole lot of work done along this line. But just as Dr Richter has pointed out, one lung will work and carry on the function of the body just as one kidney will do. That point has been shown by a lot of very good work.

Dr. John Young Brown, of St. Louis, read a paper before the Illinois State Medical Society a few years ago, in which he reported some twelve or fourteen cases of rupture of the diaphragm, where he opened the chest wall and repaired the rupture through the transthoracic route, showing definitely that this work could be done without danger. He only lost two of his cases. He showed that this work can be done very well without any elaborate apparatus.

Dr. Wm J. Mayo often does his kidney work by resecting the twelfth rib. He has told me several times that in a number of cases he has opened the pleural cavity in resecting the twelfth rib in his kidney work, although he has never had any trouble whatever. He has made immediate closure. Personally, I have had a number of experiences of opening the pleura. I have always had the fear of doing it and of making artificial pneumothorax. I have done that a number of times, but with no serious trouble unless infection follows. I am thoroughly convinced we can take the position which Dr. Richter has so well laid down, that if one lung is normal, and you are operating on the other lung, you do not need all these complicated apparatuses, that you can go ahead and operate under proper anesthesia, and if you do not get infection, you can do a great deal of work on that side without any trouble. Take the work that Dr. John R. McDill<sup>1</sup> has done of transthoracic opening of liver abscesses. This is a very good scheme. In the McDill scheme of exposing the upper surface of the liver by the transthoracic route, he takes particular care to try and avoid opening the pleural cavity, but you may be sure that he sometimes has a collapsed lung. Suppose he wants to attack the subphrenic space or upper surface of the liver: he will make a concave incision, resecting one or two ribs subperiosteally; then he will have his assistant hold his fingers on the flaccid chest wall from which the ribs have been removed, and push the flaccid wall against the diaphragm, then he cuts through the chest wall and cuts through the diaphragm, then he will sew up the chest wall and diaphragm together, whip them up with a continuous suture or whipping suture so as to hold the chest wall and diaphragm together and close the pleural cavity so that you can open the subphrenic or abscess of the liver or do any operation in that way. You may be sure, in the hundred or more cases that John McDill has operated upon in that way, in many of them he has had collapse of the lung. He had immediate closure of the pleural cavity with a given suture line, and, as a rule, no resulting infection. Of course, occasionally there is an infection; I should not hesitate at all in a case of rupture of the diaphragm to-day, where the individual had any trouble with the other lung, to attack the lesion through the transthoracic route without any special form of pressure apparatus, and with a good anæsthetic sew it up just as I would an ordinary hernia, and then make a clean closure of the thoracic wound,

<sup>1</sup>McDill, John R. Surg., Gynec. & Obst. 1911, 224, 223

with the expectation that the air in the chest would be taken care of within a short time and the interference with the lung function would be of little moment in the case, provided I had succeeded in excluding any infection.

DR. E. WYLLYS ANDREWS: This paper and the discussion on it have taken a direction in which I have made something of a hobby of late years, since not long ago I had five cases of operative treatment of wounds of the diaphragm in one year. One point which has been emphasized is that opening the pleural cavity may be a perfectly harmless thing. The other is the necessity of treating these diaphragm lesions through the chest and not through the peritoneum. We used to hear from Willard's experiments and those of others of rushing cool air into the pleura, producing shock and collapse and dyspnea. It does not do anything of the kind. I have done it accidentally, and have been foolishly terrified by the hissing sound of a little air entering when resecting a tuberculous rib, or operating upon a kidney, or in trying to reach an abscess of the liver. Having found that we were unnecessarily alarmed over this, we have gone a little farther and let air in deliberately with no bad result. Within a year I have freely incised the chest, taken out four or five ribs, and removed a carcinoma of the mamma. We used to think this almost as dangerous as letting air into the jugular vein. Opening the pleural cavity does not only not endanger life, but I have seen with my own eyes several instances in which the lung did not collapse at all. I believe the lung can lie exposed against a large lesion of the side of the chest and remain perfectly expanded and continue to expand with all the suction pressure of the chest and diaphragm removed, or at least, the suction pressure of the chest.

I had a case, about a year ago, in which the diaphragm was ruptured by internal pressure from a traumatic hernia, the colon being pushed up through it, and, at the same time, the ribs were detached, four in number, from the sternum in front. I tried to reduce the colon and suture the wound and the diaphragm through the chest, but during that operation and the time required to make the replacement, the lung was actively expanding and pushing itself out into the open area just as if it were being blown up with a positive bellows. I cannot understand that, but I saw it. Of course, we would infer the reason of the lung expanding is suction of the chest wall by the vacuum about the lung, just as if it were tightly agglutinated to the ribs and diaphragm. But in at least two instances, and I think in others, I

have seen the lung in the wounded chest with a comparatively large hole through the chest wall and skin actively expanding itself as if the chest wall were not open at all.

To repair a wound of the diaphragm, the trans-thoracic route is the proper one. I think it is only fair to insist on it by way of warning those whose first impulse is to attack such a lesion through the peritoneum. We are accustomed to working in this cavity, and we first think it is easy to suture the diaphragm from below. The moment you have a large experience with these cases and follow up the literature, you will find by your own experience and by the uniform testimony of others who have tried it, that it is the most difficult operation you can possibly attempt. It is most inaccessible and tedious to reach the lower surface of the diaphragm. On the other hand, if you open one side of the chest freely to expose the diaphragm, there is practically no distance from the ribs inward. It is a dome-shaped affair, scarcely half an inch away from outer chest wall at the seventh to tenth rib. I will go a step further and say that we should often do a laparotomy transpleurally, say for a liver abscess or growth, or for operations on the cardiac orifice of the stomach. I give a very fair drawing of this technique (taken from Cranwell of Rio Janeiro) in my article in Vol VII, Bryant and Buck's Surgery. Some fine plates and descriptions are also to be found in Sauerbrück's new book, "Thoraxchirurgie."

DR. COLEMAN G. BUFORD: After one has had considerable experience in chest work, he finds that it is not necessary to adopt complicated methods in the large majority of troubles like that in question. It does not take long to ascertain how much real work can be done through the chest wall, when the lung is already collapsed. This collapse can be brought about through a simple stab wound of the thorax or by resection of the ribs with little if any resultant difficulty in breathing. Each of us has seen how little disturbance in this connection has been caused, when we have been called upon to drain one side of the chest for empyema and how much available operative space there is in the thorax. We may go still further and recall the experience of others, if not within our own experience, who have even drained both sides of the thorax for empyema with favorable outcomes. It therefore seems to me quite rational to resect the chest wall and use this as the operative field in cases where the diaphragm has been ruptured and the viscera have prolapsed into the thorax. I feel as Dr. Andrews does about it, that this is the most accessible

field for repair of the diaphragm. It occurs to me this moment that there might be occasions when one would want to repair the diaphragm on one side and immediately expand the lung on that side to facilitate breathing and follow it by repair of wounds in the other thoracic cavity. In this connection, I recall an experience I had a short time ago. I resected the chest wall for secondary carcinoma. Dr. Bevan saw this case with me. I took out parts of two ribs. In doing this I easily teased off the pleura, but while suturing the skin, the pleura was punctured and the lung collapsed. The opening immediately gaped instead of closing. The pleura was so thin I could not suture it. The skin and cellular tissue were sutured tightly, thus completely closing the wound. I now put a trochar in the chest wall, aspirating all of the air that I could, which permitted of immediate lung expansion to the extent that the lower posterior border was about two fingers' breadth higher than it should be. On the third day the lung boundary was normal. This plan of management might be more generally practiced than it is in wounds of the thorax, permitting of immediate closure.

DR. L. L. McARTHUR: I would like to say, that possibly there is a misconception in regard to Dr. Riebel's statement, that the pressure within the lung was raised from forty to sixty millimeters of mercury in using the Meltzer apparatus. That pressure may be shown in the manometer, but the catheter, not filling the entire trachea, permits air to escape, so manometer does not measure the actual pressure within the bronchi themselves. I, too, have shown to this society a case of resection of the chest wall en bloc for carcinoma, in which I proceeded boldly to resect an area in the chest wall involving two ribs, the pericardium being brought distinctly in view and the lung collapsed, then suturing more snugly than usual the temporarily reflected skin and superficial tissues. I aspirated the chest cavity immediately of the air left there, using a protected needle (a needle that has a sharp point for penetration, but as soon as it enters the chest cavity is covered with a rounded point that prevents injury to the lungs). I immediately succeeded in expanding the lung to its full

amount. We could feel it against the needle low down in the chest cavity. The aid which comes from increasing the pressure in the lungs, by any one of the positive pressure apparatuses, is particularly great and efficient when it comes to suture of the lung substance, or suture of the lung to the chest wall, as is sometimes desirable when the lung is later, at a second step, to be penetrated.

DR. RIEBEL (closing): There is one fact I tried to point out, namely, that so many investigators differ in their conception of a pneumothorax. Collapse of the lung alone is not pneumothorax. That is the reason why I described my case in the human resembling an experiment; the chest wall was held open with two retractors and there was no disturbance at all. An internal or tension pneumothorax, on the other hand, is the most dangerous form we have, and prolapse of the organs containing air into the chest cavity is equivalent to that, causing derangement of the relations within the chest cavity and serious disturbances of internal respiration.

I looked over the article of Dr. Brown which Dr. Bevan referred to, and, as I understood it, he did not cite any subcutaneous ruptures. His cases were all instances of stab wounds with wounds of the diaphragm.

DR. BEVAN: They were all traumatic.

DR. RIEBEL: They were all open wounds, but mine was a subcutaneous rupture of the diaphragm, and in a case like that, with marked muscular defense, the possibility of an injury of an abdominal organ would have to be considered. I find in the literature a good many cases of stab wounds of the chest, where finally laparotomy had to be done to reduce the prolapse which was not possible from above.

It is too late to answer all the points brought out by Dr. Richter and to go into the differences between the value of Meltzer's positive pressure and that of Brauer, suffice it to say it is of entirely different character. The positive pressure Dr. Richter has been working with is static in character, whereas Meltzer's is dynamic. Regarding pressure differences, that is a mistake. I did not mention sixty. The highest pressure I used was forty, and then, of course, it was that only at the manometer.

## WASHINGTON SURGICAL SOCIETY

REGULAR MEETING HELD MAY 17, 1912, WITH THE PRESIDENT, DR. CARR, IN THE CHAIR

DR. FOWLER reported four cases, with specimens, of suprapubic prostatectomy, illustrating the good results of this method in selected cases having large and medium sized adenomatous prostates. There is no danger to the rectum and the ejaculatory ducts are preserved. After opening the bladder, incision into the prostatic mucosa is not necessary, as a satisfactory plane of cleavage can be found in the prostatic urethra. It is not necessary to introduce the hand into the bladder, but it is of great assistance to keep a finger in the rectum. He believes in packing the cavity with gauze, as being safer and more surgical than depending on hot irrigations. Packing should be wholly or partly removed in twenty-four hours to prevent possible necrosis of rectal wall. Appropriate pre- and post-operative treatment is of great importance in these cases.

DR. BALLOCH noted that nothing was said of prior cystoscopy in these cases, which by some is considered so important. He is glad to see that the suprapubic operation is gaining in favor, as he thinks it less dangerous, though not practicable in all cases. It is interesting to note the method of commencing enucleation by the way of the prostatic urethra.

DR. HAGNER thinks cystoscopy advisable as a routine, as methods of procedure may be altered thereby. A few years ago he used the perineal route exclusively, though he now agrees that certain cases are best treated suprapubically, it is practically impossible, however, to remove a small hard prostate from above. He advises in badly infected bladders to operate in two stages, by draining the bladder for a week or two, using nearly continuous irrigation. He always packs the wound.

DR. FOWLER said that in these particular cases cystoscopy was not necessary, though he uses it as a rule. He agreed as to the advisability of a two-stage operation in bad cases. Many large prostates are not true cases of hypertrophy, but are adenomata, the prostate itself being pushed aside. By the procedure described, the ejaculatory ducts are preserved and in the four cases mentioned sexual power was retained.

DR. THOMAS ABBE read the paper of the evening entitled, "How can we improve the results of our operations for cancer?" (See p. 185).

In discussion, DR. CARR said the subject was timely, as cancer is unquestionably on the increase

all over the world, it is possible that modern methods of life, with overeating and overwork, may cause a precancerous condition. Trauma may be an immediate cause, but only in a case with the already developed tendency. One reason for incomplete operations is the leaving of too much skin, especially in breast cancer, as pointed out especially by Halstead. He has always freely used bichloride in these operations, with a view to destroying detached cancer cells. The great question is that of operability, and he thinks we should hesitate to pronounce a case hopeless. There is a great field for the education of the general practitioner in the diagnosis and prognosis of cancer.

DR. G. BROWN MILLER mentioned the opinion, as to cancer of the uterus, of the German authority, Kröning, who deprecates the skepticism as to cure in these cases. He operates, or tries to operate, 83 per cent of these cases, and while he loses 20 per cent of the cases, yet at the end of five years he had a greater percentage of cures than any other surgeon. In all cases presented 25 per cent or 30 per cent of cases were cured. Dr. Miller had always believed a wide area of involvement, with fixation, as hopeless, but now believes in laparotomy to see if fixation is simple or cancerous. He, too, thinks much can be done in educating both the profession and the public.

DR. HAGNER said that many bladder and prostate cases had had symptoms a long time before any positive attempts at diagnosis were made, whereas the only hope was in a very early interference. If a radical operation cannot be done, it is probably best to do nothing at all, as interference seems only to accelerate the growth.

DR. THOMAS CHARLES MARTIN urged the importance of proctoscopic examination of every marked case of constipation or diarrhoea or both. The usual finding is a more or less irregular mass, above the levator, which may or may not bleed. An apparent mass, due to rectitis with local induration, may disappear on dilatation.

DR. FOWLER said that many cases of prostatic hypertrophy showed areas of malignant degeneration, usually situated deeply in the gland and removed with it, especially in the hard scirrhous type. He agrees with Dr. Hagner as to stirring up a hopeless tumor, whose growth is usually slow. As an interesting fact, he had never seen

cancer of the penis where there had not been an adherent prepuce

DR. ABBE in closing said he wished to emphasize the importance of education in the cancer problem, education had been of such value in tubercu-

losis and other health problems, and that the public is now in a receptive mood toward trustworthy information on all such matters, he hoped that a concerted effort would soon be made in that direction.

## CORRESPONDENCE

### GUNSHOT WOUNDS OF THE CHINESE WAR

The total casualties in the recent civil war in China may never be determined. The Chinese leaders say they do not know. The foreign doctors and others who did Red Cross work at Hankow estimate that those killed number 10,000. These men did field work and manned the base hospitals. Moreover, thousands of the dead had to be buried under foreign supervision, and so this estimate for Hankow may be taken as quite near the truth.

But how many wounded there were it would be still harder to say. One doctor of the Shanghai Red Cross Society who spent a short time at Hankow estimated the number of wounded at 15,000. But members of the local Red Cross Association who were at work from the beginning of the war till the close say that it is impossible to name any definite number. About 10,000 wounded were treated in foreign hospitals in Hankow, Hanyang and Wuchang.

**Military equipment.** Both armies were equipped along modern lines. The nucleus of the Imperial army was built up by Yuan Shi Kai over ten years ago. The men had modern rifles, field guns, and large cannon, and they were trained in their use. They were disciplined and there was no needless exposure to gun fire in battle. Their uniforms and first aid pockets were ample compared with those of their opponents, the Republicans. The Imperialists used a 27 mm rifle made in Shanghai and Tientsin built after Mauser and Mannlicher models. The length of the bullet was something over 3 cm. It was slightly longer than that used by the revolutionists, and it had a truer nose. In their machine guns, they used 32 cal bullets, sharp and conical pointed. The first aid packet contained gauze, adhesive, and one triangular bandage with diagrams showing its use printed on the wrapper.

In comparison, the revolutionary army was

hastily gathered together. And, while far larger in number, the soldiers were poorly trained in military tactics and in the use of guns. They received more wounds and their firing was less effective than their opponents'. "One dead Imp means two dead Reps," was a common estimate made. The revolutionists used a model 83 Mauser rifle of 312 caliber. The bullets were thick, short, and blunt. Five hundred, 45-70 rifles using lead bullets were issued to the revolutionists. Bullets of hard wood, about 4 cm. long, stained indigo, and mounted in cartridges having a full charge of powder were sometimes found on, but never in, the republican soldiers. They were not provided with first aid packets. Their personal equipment consisted of what they could get.

**Field work.** The field workers were supplied with bandages, gauze, splints, morphine, and iodine. A five per cent solution of iodine was applied to all wounds. In from one to twelve hours, and sometimes longer, most of the patients were carried off the battlefield and carried into the base hospitals. Coolies were used to transport the wounded to and again from the Red Cross launches which were used to convey the wounded from the several river points to the base hospitals in the foreign concessions of Hankow. The doctor in charge of the field work had opportunity to observe also the work in the base hospitals, and he found no bad results accruing from iodine, even in cases where considerable absorption undoubtedly took place, as in shrapnel wounds. The splendid results from a free use of iodine, both in first aid work on the battlefield and in the hospitals, made many of the Red Cross doctors stanch preachers of the gospel of iodine.

**Base hospitals.** Fortunately, in Hankow there are a number of large mission hospitals, also an international hospital, whose doors were thrown

open to the wounded soldiers of both sides indiscriminately. A large cathedral was also used for a time for minor cases. The medical missionaries assumed a large share of the work, especially through an efficient local Red Cross organization, which enjoyed the confidence of both armies. In addition, there were the private practitioners who gave themselves untiringly, as did a number of doctors from the various gunboats of different nationalities. At the height of the fighting there were eight permanent or temporary hospitals at work. In some were soldiers of both armies.

*Kinds of wounds.* High velocity rifle bullet wounds were the most frequent. Shrapnel wounds were more frequent among the Republican ranks than the Imperialist. Because of the manner in which they were inflicted, bayonet wounds were fatal and almost never brought into the base hospitals. The same may be said of those wounds made by short knives in which the jugular vein and the common carotid artery were cut. There were quite a number wounded in the back, who, because of poor training and discipline, were shot accidentally by excited comrades in the rear.

*Wounds clinically.* The rifle bullet wounds, generally speaking, were of three distinct types. The damage done by the sharply pointed machine gun bullets was small unless a vital organ was affected. Infected material was seldom carried in. The openings through the skin were remarkably small. The wounds usually were clean. Many healed by first intention. The regulation rifle bullet of the Imperialist equipment did greater damage. But the worst wounds of all were those inflicted by the blunt-nosed, thick-bodied bullets of the Revolutionists. Clothing was more often carried in. The holes through the skin were larger. There was a more extensive mutilation of the soft tissues. When bone was involved it was usually comminuted or crushed, with small fragments lying in the tissues beyond. The wounds were more frequently infected, and the cases did not do so well, no matter where they were hit.

*Infection.* There were a number of predisposing causes leading to infection. (a) Cleanliness on the part of the soldiers was exceptional, owing to the class of men who are always the first to enlist. Even if an attempt had been made to enforce personal cleanliness and other sanitary measures, the cold weather and general lack of discipline would have made such a condition impossible. (b) Clothing was more often dirty than clean. Some of the more fortunate soldiers had on from three to seven layers of it. As

many new uniforms as possible were issued by both armies, but there were thousands of men who wore their own clothes, which had seen months, and perhaps years, of service, with the result that there were both ancient and modern filth waiting to be carried into the wounds. (c) Delayed transmission was a third factor. The revolutionists were more helpless in this respect than the Imperialists. When it came to fighting close to Hankow, both sides owe much to the work of foreigners residing in Hankow, who had the wounded taken off the field to where prompt and adequate attention could be given them. Of course, there were many shot miles from Hankow. Interesting cases came in days after they had been shot. The skin wounds had closed, and there had resulted extensive retention of pus, which had burrowed along the fascial sheaths. The Revolutionists had no field or ambulance corps. Both sides abused the Red Cross badge and were careless about shooting when the wounded were being taken off the field. With Imperial soldiers, where an amputation was called for at once, it was necessary to get the consent of the company and division commanders before the operation was undertaken.

*Treatment.* A few comments on the usual treatment may be of interest.

There were no attempts at any sort of probing where the bullet was deeply buried and no operation was indicated. Tincture of iodine dressings were applied.

Compound fractures were opened and drained as soon as possible. Normal salt or weak iodine solutions were used for irrigation.

There was some gangrene in cases where we played a waiting game. Dry gangrene usually cleared up nicely. The few cases of moist gangrene caused much trouble.

Few abdominal wounds developed peritonitis when left alone, usually in those cases where the patient had been without much food for three or four days. Because of the uncertainty of sepsis, even under the conditions there present, the abdomen was left alone. Many cases, however, had retention of the bladder, which was relieved suprapubically as a last resort.

In bullet wounds through the chest, the white of a raw egg was drawn up into a syringe and without further preparation injected into the wound.

There were three cases shot through the heart that got well. In a number of others, the diagnosis was not fully established.

This was the star case of the war: An Imperial soldier got in the way of his own machine gun

and was wounded in twenty places. He was shot through the jaw, the shoulder, the abdomen, the femur without a fracture, and the heart. The patient lived

W. W. PETERS.

Kiukiang, China.

To the Editor: The undersigned is very greatly interested in the subject of "Pregnancy after Oophorectomy," and would appreciate certain information from readers of your journal who have had cases of this kind, and care to favor him with an account of the same. The facts desired involve the question of the relief of sterility following this operation, the character of the labor where pregnancy has occurred, the indications for removal of the ovary, the pathological condition of the same, an account of any other operations done at the same time, the character of the menstrual period subsequent to the operation, the date of birth of subsequent children, and their sex.

A blank form has been prepared which embodies these questions and which will be for-

warded in reply to a post-card request addressed to the undersigned.

Yours very truly,

GEO. W. KOSMAK, M. D.

23 East 93d Street, New York City.

Dr. Franklin H. Martin,

Dear Doctor: You will be interested to know that Gauss of Freiburg has just sent me his book of 332 pages, covering 200 cases. Is there any place in your journal where a footnote could be put in to this effect, and as an answer to a number of inquiries that have come to me concerning my article, to-wit: "The Last Word on the X-ray in Gynecology." The new book by Prof. C. J. Gauss and Dr. H. Lembcke is "Röntgentherapie, ihre theoretischen Grundlagen, ihre praktische Anwendung und ihre klinischen Erfolge an der Freiburger Universitäts Frauenklinik," published by Urban & Schwarzenberg, Berlin, and Vienna, pp 332, price, 15 marks. In the trip of the American Gynecological Club, the work in this clinic was more advanced than any that was seen.

ROBT L DICKINSON

## BOOKS RECEIVED

TEXT-BOOK OF GENERAL AND SPECIAL PATHOLOGY By Henry T Brooks Philadelphia F A Davis Co, 1912

ZUR KENNNTNIS DES UTERUSCARZINOMS By J Schott laender and F Kermanner Berlin S Karger, 1912

THE PRACTICE OF OBSTETRICS Fourth Edition Revised By J Clifton Edgar, M D Philadelphia P Blakiston's Son & Co, 1912

A SYSTEM OF SURGERY Vols I and II By C C Choyce B Sc, M D, F R C S London and New York Funk & Wagnalls Co, 1912

THE PRACTICE OF DENTISTRY By Leo Greenbaum, M D, D D S, and Max Greenbaum, D D S New York D Appleton & Co 1912

ANESTHETICS AND THEIR ADMINISTRATION, Fourth Edition By Sir Frederick W Hewitt, M V O, M A, M D London Macmillan & Co, Ltd, 1912

THE SURGICAL CLINICS OF JOHN B MURPHY, M D, Mercy Hospital, Chicago Philadelphia W B Saunders Co, 1912

HEALTH AND LONGEVITY THROUGH RATIONAL DIET By Arnold Lorand M D Philadelphia F A Davis Co, 1913

GENITO-URINARY DISEASES AND SYPHILIS, Third Edition Revised By Henry H Morton, M D Philadelphia F A Davis Co, 1912

OBSTETRICS Vol V, Practical Medicine Series By Joseph B De Lee, A M, M D Chicago The Year Book Publishers 1912

FOOD IN HEALTH AND DISEASE, Second Edition By Nathan S Davis, Jr, A M, M D Philadelphia P Blakiston's Son & Co 1912

SKIN GRAFTING By Leonard Freeman, B S, M A, M D St Louis The C V Mosby Company, 1912

ARTERIOSCLEROSIS By Louis M Warfield, M D St Louis The C V Mosby Company, 1912

THE COURSE OF OPERATIVE SURGERY By Prof Dr Victor Schmieden Translated by Arthur Turnbull, M D New York William Wood & Co, 1912

COLLECTED PAPERS BY THE STAFF OF ST MARY'S HOSPITAL—MAYO CLINIC—1911 Philadelphia W B Saunders Co, 1912

ANALYTICAL AND DIFFERENTIAL DIAGNOSIS OF THE DISEASES OF THE NERVOUS SYSTEM By Henry Hun, M D Troy, New York The Southworth Company, 1912

## BOOK REVIEWS

A CYCLOPEDIA OF AMERICAN MEDICAL BIOGRAPHY From 1610 to 1910 By Howard A. Kelly, M. D. Philadelphia and London W. B. Saunders Co., 1912

The idea of the biography is to be commended and is but another illustration of the versatile genius of its distinguished author. The work is in two volumes and biographies of over twelve hundred noteworthy figures in medicine are included. The details of such a work of necessity must be entrusted to many associates, and there is no doubt that the second edition will contain many important additions made necessary by the omissions in the present work.

The following men throughout the country have collaborated with the author in securing the material presented in the edition and have assumed the responsibility of gathering together the biographical sketches of the men from the portions of the country which they represent:

F. R. Packard and H. A. Kelly, Pennsylvania; J. A. Spalding, Maine; H. A. Kelly, New York; C. S. Caverly, Vermont; I. J. Prouty, New Hampshire; W. L. Burrage, Massachusetts; W. R. Steiner, Connecticut and Rhode Island; E. F. Cordell, Maryland; A. Robin, Delaware; R. M. Slaughter, Virginia; and West Virginia; H. A. Royster, North Carolina; R. Wilson, Jr., South Carolina; J. B. Baird, Georgia; J. S. Helms, Florida; S. D. Lamb, Washington; D. C. B. Foster, Minnesota; C. S. Sheldon, Wisconsin; L. Connor, Michigan; E. W. Andrews, Illinois; H. E. Handerson and A. G. Drury, Ohio; A. Schachner, Kentucky; A. H. Cordier, Kansas; H. W. Orr, Nebraska; J. Halpenny, Manitoba; and Northwest Territory; A. B. Atherton, New Brunswick; A. McPhail, Quebec; S. R. Jenkins, Prince Edward Island; Donald A. Campbell, Nova Scotia; Oswald M. Jones, British Columbia; L. G. LeBeuf and Rudolph Matas, Louisiana; G. M. Decherd, Texas; G. M. Kober and R. C. Coffey, Washington and Oregon; J. M. Taylor, Idaho; W. R. Tipton, New Mexico; W. B. Ewing, Utah; G. H. Kress, California; N. A. Powell, Ontario.

DISEASES OF WOMEN A PRACTICAL TEXT BOOK By Arthur H. N. Lewers, M. D. London and New York Paul B. Hoeber, 1912

In offering this new edition of a work long well known and popular in the British Isles, the publishers have presented it in improved form, the size of the volume having been considerably enlarged. Thus, while the author has rewritten many chapters and added much new matter, the entire work having

undergone revision, even to the illustrations, there has been no appreciable increase in the number of pages. Throughout, the author adheres to his original purpose of offering the practitioner and student a text essentially practical. Therefore the clinical features of the volume have been retained, and from this point of view the arrangement is unaltered. As in previous editions, too, numerous cases are detailed in the text for the purpose of illustrating points where emphasis is desired. Two short appendices have been added—one a note on the systematic treatment of nerve prostration and hysteria wherein the Weir Mitchell treatment is described, the other a short discussion of coccygodynia.

A full description of the Wertheim radical operation for uterine cancer is one of the additions, and the section devoted to fibroid tumors has been largely amplified. Both the Webster and the Dudley operation for shortening the round ligaments is offered as is a modification of the original Tait "flap splitting" procedure for perineal relaxation. Dudley is drawn on again for his anterior vaginal wall operation in cystocele with urinary incontinence, and for his plate illustrating the menstrual cycle, which is too diagrammatic. In closing up the abdominal wall after laparotomy the author imbricates the fascial layers, as is excellently described by a colored plate. Cervical "erosion" is ably set forth but unlike other English authors, Lewers regards it as of relatively little importance, and does not mention it in treating of the etiology of carcinoma. No effort is made to reclassify those conditions enrolled under the title of "endometritis," and curettage remains as the operative treatment.

Illustrations are profuse and for the most part excellent. Particularly helpful are the plates in black and white and in colors. Unfortunately the microphotographs disclose the fault usually found in such illustrations, that of loss of definition in the reproduction. The imprint is excellent and, taken altogether, this new edition more than justifies the author's aim to provide a practical text.

CAREY CULBERTSON

TUMORS OF THE JAWS By Charles Locke Scudder, M. D. Philadelphia and London W. B. Saunders Co., 1912

On reading this book one must be impressed with the desirability of the monograph as a means of presenting such subjects.

Tumors of the jaws and mouth have not in the past received the attention that their importance merits, and no single publication has so fully and satisfactorily covered the field as does this book.



The value of the volume is added to by an article on "Leontiasis ossea" by Dr. Allen H. Kanavel, of Chicago.

The author very properly emphasizes the importance of early diagnosis in new growths of the jaws, in order that mutilating surgery may not be necessary and life conserved. One can find little in the book to criticize and much to commend. It is questionable whether the term epulis should be retained, however, the author has plenty of precedent for its use. Epulis means upon the gum, and when used to designate a connective tissue growth springing from the periodontal membrane or from the periosteum, is misleading. The author speaks of ulcerated teeth, meaning abscessed teeth. This misnomer is borrowed from the luty and should not be employed. These minor matters are so insignificant that they should scarcely be noted. The illustrations are numerous and excellent, adding much to the value of the publication. The type, paper and general makeup is the very best. The profession will profit much through Dr. Scudder's contribution to a most important subject.

THOMAS L. GILMER

**BRAIN AND SPINAL CORD** By Dr. Med. Emul Villiger, translated by George A. Piersol, M. D., Sc. D. Philadelphia and London: J. B. Lippincott Co. 1912

In translating Dr. Villiger's "Brain and Spinal Cord" so that it becomes accessible to American medical students, Dr. Piersol should have the thanks of all those who have to do with the teaching of this subject. The clearness of Dr. Villiger's text and the conciseness with which he states the abstruse facts in connection with the anatomy of the brain and the spinal cord have made it a favorite volume. In the translation of this third edition Dr. Piersol has been content to give us the original with but few changes.

To those who are not familiar with this treatise, it will be of interest to know that it is divided into three parts. First, morphology, dealing with the anatomy of the various portions of the brain and spinal cord in general, second discussions of the various fiber tracts, and third, serial sections of the brain-stem. The book is to be recommended particularly because of the extraordinarily valuable pictures with which it is illustrated. The graphic representation of the courses pursued by the fiber tracts makes the subject so clear that one hardly needs to read the text if he is at all familiar with the general facts.

To the student the book is especially valuable, because by means of these valuable pictures he is able to follow the subject, which at best is very difficult of understanding, and to the practitioner a simple review of the pictures will be sufficient to refresh his memory as to these facts.

All told, the book makes a volume of over 280 pages, and is a credit both to the translator and the publisher.

**LATERAL CURVATURE OF THE SPINE AND ROUND SHOULDERS** By Robt. W. Lovett, M. D. Philadelphia P. Blakiston's Son & Co., 1912

The second edition of this little work, revised and with a new chapter on "The Relation of School Life to Scoliosis," is the most complete monograph on the subject in English. The author has been doing original work in the pathology, mechanics, and treatment of scoliosis for more than a decade, and has embodied the results of his studies and experiences, as well as the valuable contributions to the subject by others, in a very readable little book. It should be of value and interest to all orthopedic surgeons and others who undertake the treatment of spinal deformities.

J. L. PORTER

**A SYSTEM OF TREATMENT BY MANY WRITERS** Vols. I-II of General Medicine and Surgery. Edited by Arthur Latham, M. A., M. D., and T. Crisp, M. B., B. S. New York: The Macmillan Company, 1912

The idea of having works which consider disease from the standpoint of treatment seems to be growing in force, the demand coming from the busy general practitioner, who wishes to rush direct to the treatment of some disease without referring to the symptoms, pathology, or other items of the complex picture. This may be all right, and perhaps it will familiarize men with the newer modes of treatment, but to me it seems somewhat illogical. So we wish to consider these volumes from the quality of what they offer rather than any particular belief we may have in the correctness of the idea.

If we should seek to criticize the arrangement there would be no end, and the reader would find himself regarding the volumes with the idea that he could improve upon them in this line, but after going through the books very carefully we have decided that the editors have had their own troubles, and that this feature is about as clear as it is possible to be made. And although the reader may be misled in some of the groupings, the index is the most thorough and accurate of any book we have considered, as any subject may be found under two or three different heads.

Each subject is treated with a conciseness and clearness that are very commendable, and the reader who follows his text closely will find all of the necessary details present.

The illustrations are profuse where necessary, and serve to make the book interesting to those who enjoy illustrations. The articles on the operative treatment of fractures by W. Arbuthnot Lane and on orthopedic surgery by Robert Jones are especially well illustrated.

The print is good, the paper thin and agreeable to handle. On the whole, we feel that these volumes will be of great value to many physicians.

WM. R. CUBBINS





*E. Wyllys Andrews,*

Chairman, Committee on Arrangements for Chicago Session, November, 1913

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## SURGERY OF THE SPLEEN

By WILLIAM J. MAYO, M.D. ROCHESTER, MINNESOTA

WE have acquired a fairly exact knowledge of the function of all the organs contained in the abdomen with the exception of the liver and the spleen, two organs which are closely associated in their physiology and pathology.

The liver is essential to life. One of its chief functions is to receive the products of gastro-intestinal absorption and change them into tissue-building material.

The spleen is not essential to life. It performs for the general circulation a function somewhat analogous to the digestive organs, removing from the blood broken-down corpuscles and other material of probable nutritive value, which is sent as part of the portal circulation to the liver for further elaboration. It is also concerned in the metabolism of iron.

In its ontogeny, the spleen possibly goes back to a time before the development of the cerebro-spinal nervous system. This is indicated by the fact that its only known nerve supply consists of filaments derived from the splanchnic sympathetic to the capsule stimulation of which causes contraction. It is an organ of internal secretion controlled by chemical stimulation through the blood stream, in many respects resembling the liver. We may surmise that this form of stimulation has been quite adequate for function other wise the spleen would be more closely associated with the sympathetic ganglia as are the adrenals, the hypophysis, and other bodies of internal secretion. The internal secretions of

the adrenals and hypophysis produce their effect not only by chemical stimulation through the blood but also by direct action on the sympathetic ganglia which enables a very small amount of secretion to produce widespread results. Evidently the internal secretion of the spleen is not important since splenectomy does not produce serious results, the associated organs taking up the function.

The liver destroys poisons both chemical and bacterial, and stands as a gigantic defense of the general circulation. Bacteria picked up in the portal circulation are destroyed in the liver and according to Adams (1) pigmented areas in the liver are derived from the pigment of slaughtered bacteria. Processes in the liver which interfere with function are often accompanied by changes in the size and parenchyma of the spleen, such as the hypertrophied spleen which so often accompanies cirrhosis of the liver, while primary splenic enlargements are sometimes accompanied by secondary cirrhosis of the liver, as is seen in the late stages of splenic anemia (Banti's disease). It is probable that cirrhosis of the liver is caused by poisons sifted from the general circulation by the spleen, or by poisons from the digestive tract carried by means of the portal circulation to the liver.

The celiac axis supplies the blood to the stomach, pancreas, liver, and spleen, showing the primitive association of function, just as the superior mesenteric artery outlines the intestinal tract derived from the midgut and



Fig. 1

the inferior mesenteric artery outlines the greater part of the alimentary canal derived from the hindgut. All of the venous return from the celiac axis, superior mesenteric, and inferior mesenteric vessels unite to form the portal circulation.

During the early months of fetal life, the spleen, the liver and the bone marrow, as well as the lymphoid and adenoid tissues of the body, are all concerned in the formation of blood. This primitive function of the liver is lost at an early period, but is continued in the spleen to some extent throughout life.

The spleen is found in all red-blooded vertebrates, and is peculiar in that the blood comes in actual contact with the parenchyma of the organ. In the fetus it appears to have the power of producing both red and white corpuscles. After birth the function of producing red blood corpuscles is probably lost, although the ability to produce white blood corpuscles is maintained. Not only is the function of producing red blood corpuscles

lost in the spleen at this time, but it assumes the function of a destroyer of the obsolete red blood corpuscles. The great size of the splenic artery permits all of the blood of the body to pass rapidly through the spleen, which quickly strains out the broken-down cellular elements as well as bacteria and other micro organisms. The spleen does not appear to have the power to destroy the micro organisms it captures, therefore the organisms are delivered for destruction to the liver through the portal circulation.

In the perversion of this dual function most of the diseases common to the spleen have their origin. A great overproduction of white blood corpuscles, associated with an enlarged spleen, constitutes leukemia of the splenic type. An excess of function in the destruction of the red blood corpuscles produces not only hyperplasia of the spleen but an attending anemia from which splenic anemia takes its name. The enlarged spleen, (ague cake of malaria) must be considered a conservative hyperplasia in its inception, although in the later stages it becomes the habitat of malarial organisms which it appears unable to destroy or to deliver to the liver for destruction.

With the present inefficient methods of diagnosis a diseased spleen is not often accurately mapped out until its size is made manifest on palpation beyond the free border of the ribs. The deep situation of the spleen and its relation to the stomach, colon, and intestine, as well as the left thorax, renders accurate outlining before this time open to question, and the fact remains that in the large majority of cases we have no correct knowledge of the actual condition of the spleen until it can be felt at the border of the left hypochondrium.

#### SPLenic ENLARGEMENTS

*Myelogenous leukemia.* Enlargement of the spleen with an excess of white corpuscles is a characteristic of myelogenous leukemia, and the micro-copic examination of the blood shows a definite picture which is essential to a diagnosis.

The blood of the most primitive animals is white, in a higher stage of development red

blood corpuscles are found, but they are developed from the white corpuscles. The earliest blood found in the fetus is white, and at this period of development the liver, spleen, lymphoid and adenoid structures of the body, and the bone marrow are blood producing organs. Leukemia appears to be a reversion to the embryonic type of blood, in which all of the original blood-making organs have to do with the overproduction of the white cells, just as carcinoma is due to the unlimited production of embryonic epithelial cells, and sarcoma is due to the unlimited production of embryonic connective tissue cells.

The leukæmic spleen has been removed a number of times, and in practically all of the cases in which the diagnosis was established the patient died promptly as the result of the operation. Even if this were not the case since the leukæmic spleen is but a part of the general condition splenectomy would be unavailing.

*Splenic anemia.* This condition is probably a definite entity. Banti (2), Osler (3) and later Armstrong (4) describe it as a progressive disease characterized by an enlarged spleen, by a reduction in the number and value of the red blood corpuscles and low hæmoglobin, and often by a reduction in the number of white blood corpuscles. Clinically this disease may be accompanied by hemorrhages, especially from the stomach, by progressive weakness, and often by pigmentation of the skin and chronic jaundice. Banti's disease is simply a late phase of splenic anemia. It is marked by splenic hypertrophy, with cirrhosis of the liver, occasionally jaundice and often ascites.

The condition of the blood in splenic anemia is interesting. As a rule, the red blood corpuscles drop under 4,000,000, often to 3,000,000, and the hæmoglobin to the vicinity of 40 per cent. The white corpuscles vary from 3,500 to normal. The differential count is usually unchanged. After the removal of the spleen the blood picture becomes more nearly normal, although as a rule for some months there are variations at different times. When this particular grade of secondary anemia exists in connection with an enlarged spleen and the cardinal symptoms previously

mentioned, a diagnosis of splenic anemia can be established, not upon one sign or symptom, but upon the complete clinical picture; and if the disease be uncomplicated, splenectomy may be expected to cure the patient. We have removed the spleen in eighteen cases of splenic anemia with gratifying results.

Peri-splinitis may exist to such an extent in association with splenic anemia that the spleen cannot be removed without enormous risk to life. Hepatic cirrhosis with peri-hepatitis may also be present in these cases, the liver and spleen often being encapsulated to a remarkable degree. Because of such complications, splenectomy was abandoned in one of our cases. It is sometimes difficult to determine whether an enlarged spleen with cirrhosis of the liver is a Banti's disease primarily, or whether the splenic hyperplasia is the result of a primary cirrhosis of the liver.

Following splenectomy there was pain for a time in the long bones in about 25 per cent of our cases, and in one or two cases a temporary enlargement of the lymphatics, evidently a compensatory hypertrophy of the bone marrow and glands, as has been noted by Warthin (5).

There is a type of enlarged spleen of unknown causation not accompanied by anemia, an essential hyperplasia. I have personally observed two cases in which the enlarged spleen had existed in one case eight years in the other six, with the patients in fair health.

*Conservative splenic enlargements.* The biologic study of micro-organisms found in the blood is interesting. Bacteria such as tubercle bacilli, bacillus typhosis, pus-producing organisms, etc., are vegetable parasites and are more resistant to chemical poisons, such as bichloride of mercury, etc., than their animal host, therefore bactericides usually fail to destroy them. Methods of treatment based upon increasing bodily resistance through the development of opsonins give the best results in diseases caused by these vegetable parasites. Animal parasites or protozoa, on the contrary, are destroyed by specific poisons, such as quinine for the plasmodium of malaria, mercury for the spirochetes of syphilis, etc. Both vegetable and



Fig. 4

## NEW GROWTHS

*Cysts of the spleen* The most common form of non-parasitic tumors of the spleen is the cystic spleen, in the great majority of cases primarily due to hemorrhage within its capsule. I refer those interested in this phase of the subject to an excellent article by Powers (8).

*Sarcoma of the spleen.* Sarcoma is the type of primary malignant disease of the spleen and is rare. Gaucher (9) described a certain proliferation of the endothelium of the venous sinuses as a neoplasm. The tumor of Gaucher must be considered the same type as that of which Weichselbaum (10), in 1881, reported two cases, calling them primary endotheliomas. Jepson and Albert (11), found 32 such cases, in which splenectomy was made in 10. There were three deaths and four cures in this series, one alive six and one half and one four years after operation. In a critical analysis Fowler (12) reduces the 32 cases to 14, which he believes were true sarcomas and the balance nodular hyperplasias. McConnell (13) throws doubt on this data, believing that the cures occurred in cases of chronic hyperplasia and not in the sarcoma group. Pathologists are divided in their opinion as regards these tumors; some hold that they are sarcomas, and others that they are a type of hyperplasia. Histologically, many of these tumors appear to be neoplasms, but are peculiar in that when they exist primarily in the spleen they are comparatively benign, and if removed early may be cured. One patient with lymphosarcoma of the spleen was operated on in our clinic, November 14, 1905, and is in excellent health to-day. Three cases of the Weichselbaum and Gaucher type of splenic tumor which have been operated on by us were clinically splenic anemias. Two have remained well since, one dying from the operation.

*Splenectomy.* It is unfortunate that our main recourse in surgical diseases of the spleen is destructive. As a rule, the disease is advanced before a diagnosis is made, and usually the entire organ is involved, making splenectomy the only rational procedure.

The blood supply of the spleen can be reduced by ligation of some of the secondary arteries in the hilum. Whether this would reduce its function sufficiently to be of practical value I do not know, but it might be tried in some cases in which splenectomy could not be performed. In the somewhat analogous condition of hyperthyroidism, ligation of the thyroid vessels has given remarkable results.

For the removal of a large spleen an incision is made in the outer margin of the left rectus muscle extending from the costal arch downward until there is a space sufficient for manipulation. For smaller spleens a transverse incision is practicable. On opening the abdomen the hand is passed over the spleen under the diaphragm and if adhesions are present, they can usually be broken down with the hand. The spleen can now be brought entirely out of the abdominal incision. The fundus of the stomach and the colon come out with the spleen, and these attachments, together with the lienophrenic ligament, etc., can be tied and divided under inspection. A large gauze pack is carried up into the cavity from which the spleen has been removed temporarily to check the oozing from the separated adhesions. The spleen is then steadied and all of the attachments tied and divided until it remains attached only by its vascular pedicle. A rubber-covered elastic clamp of the Lower variety is placed on the pedicle, if possible about three inches from the spleen. If portions of the stomach or colon are caught with the pedicle by the elastic holding clamps no injury will result. This

hold prevents slipping and sudden hemorrhage from the great vascular pedicle, and the vessels can be divided close to the spleen into three or four sections and ligated carefully with catgut before the holding clamps are removed.

In hypertrophied spleens of long standing the blood-vessels are often atheromatous, necessitating great care in placing the ligatures. After ligating the vessels, the clamps on the base of the pedicle are loosened gradually, the large gauze pack is removed, and the bleeding points in the deep cavity closed with catgut on a fine needle. In one case I was unable to control the hemorrhage from the under surface of the diaphragm and was compelled to leave a large gauze pack in the cavity, removing it several days later.

The tail of the pancreas is sometimes drawn up with the pedicle and, unless care be exercised, it may be accidentally tied in the pedicle and divided. I removed one and one-half inches of the tail of the pancreas with the pedicle in one of my cases and did not discover it until I was about to drop the pedicle back. After covering the pancreatic stump with peritoneum, I fastened a one-fourth-inch rubber tube with a split in the end to the pancreatic stump with a fine catgut suture and brought it out of a stab wound. This precaution was, however, unnecessary there being no pancreatic or other drainage, although the pancreatic duct, where it was cut across, was plainly visible.

Accessory spleens, varying in size from a hazel nut to several inches in diameter, are not infrequently found in the pedicle. If the primary disease be benign, these accessory spleens may be conserved.

The mortality following splenectomy has been estimated to be from 18½ to 27½ per cent. Carstens (14) reports 739 cases, with 137 deaths (18½ per cent). Johnson (15) found a mortality of 27.4 per cent in 708 cases. Under present conditions the mortality is much smaller than these statistics appear to indicate. The operation itself, if the patient be in fair condition, should not have a

mortality of above 10 per cent, and probably not above 5 per cent. In our 27 cases there were two operative deaths.

### ANALYSIS OF CASES OF SPLENECTOMY

Mayo Clinic, from April 6, 1904, to October 21, 1912

Total splenectomies

Total operative deaths

#### Clinical diagnoses

Splenic anemia (5 showing Banti's syndrome)

Wandering spleen (recovered)

Tuberculosis (died in 4 months)

Pernicious anemia (?) (unimproved 2½ years)

Cirrhosis of liver (death within 6 mos. ascites)

Infectious (?) splenomegaly

#### Total

#### Operative results in cases of splenic anemia

Operative deaths

Well 1 to 7 years

Less than 2½ years

2½ years

3½ years

4 years

5½ years

7 years

#### Total

Improved

Death in 3 years improved until shortly before

Death 2½ years after operation cause unknown

#### Total

#### Pathologic findings in cases of splenic anemia

Lymphoid hyperplasia (Lymphoma (?) 1, Lymphoma sarcoma 1)

Endothelial proliferation (Gaucher type)

Chronic diffuse splenitis

#### Total

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March 26, 1910 Spleen weight, 1160 grams, exterior smooth, mottled, firm, cut surface hard, fibrous, lymphoid tissue increased, some swelling of endothelium in dilated venous sinuses, marked fibrosis. Pathological diagnosis, chronic diffuse splenitis.

CASE 24 A7040. Male, age 45 yrs Clin diagnosis atypical pernicious anemia Splenectomy February 9, 1910 Spleen weight, 1640 grams, exterior smooth, rather soft, cut surface soft, dark colored, lymphoid tissue increased, no apparent proliferation of endothelium, slight increase of connective tissue, very large amount of debris of broken-down blood cells and blood pigment. Pathological diagnosis, pernicious anemia.

CASE 25 H17130 Male, age 10 yrs Clin diagnosis splenic anemia Not operated, autopsy December 14, 1905 Spleen weight, 600 grams, exterior pale, hard, fibrous capsule thickened, cut surface hard, fibrous, lymphoid tissue almost entirely absent, some proliferation of endothelium, very advanced fibrosis. Pathological diagnosis diffuse chronic splenitis.

CASE 26 A64259 Female, age 20 yrs Clin diagnosis, splenic anemia Splenectomy February 26, 1912 Surgeon's diagnosis at operation primary hepatic cirrhosis Spleen weight, 750 grams. Pathological diagnosis, chronic splenitis.

CASE 27 A62258 Female, age 20 yrs Clin diagnosis, painful wandering spleen Splenectomy January 22, 1912 Spleen weight 170 grams, organ, both grossly and microscopically, apparently quite normal.

CASE 28 A11038 Female, age 39 yrs Clin diagnosis, painful floating spleen Splenectomy June 27, 1908 Spleen weight, 145 grams, exterior rough, hard, cut surface slightly fibrous, pale, apparently slight atrophy of lymphoid tissue, no change in endothelium or fibrous connective tissue. Pathological diagnosis, atrophy.

#### GENERAL DISCUSSION

##### *Group I Cases with a Positive Clinical Diagnosis of Splenic Anemia*

Of the 18 cases on whom a positive clinical diagnosis of primary splenic anemia was made, all presented the important diagnostic symptoms as laid down by Osler (33), namely, an enlarged spleen with the following blood picture: a reduced number of red cells, a reduced number of white cells without material variation from normal in the relative percentages of the several types, no leucocytosis, usually a leucopenia, a very low hæmoglobin, and a low color index. In all 18 cases, the clinical picture was sufficiently definite to warrant, even after the most critical review, a diagnosis of a secondary anemia apparently due to a primary spleno-

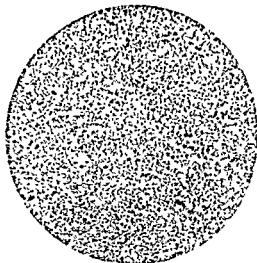


Fig 1 Case No 2 Splenic anemia Lymphoma type Spl Sec x100, lymphoma area

megaly. Of the 18 cases operated on, 2 died at operation, and of the remaining 16, 11 have remained well for periods varying from six months to seven years. Of the remaining 6, 2 are improved, one died 3 years after operation with symptoms of cirrhosis, and 2 have not been heard from.

While these 18 cases presented clinical symptoms of such uniformity as to compel the clinician to group them together, the variation in their morbid anatomy is so great that for purposes of pathological description it becomes necessary to divide them into classes as follows.

*Class A Chronic lymphocytic hyperplasia*  
This class contains two cases Nos 1 and 2. In the first case the spleen weighed 2190 grams and in the second it weighed 3275 grams, or 13 and 19 times the normal weight, respectively (females). In both, the surface was smooth and the tissue was soft and dark red in color. On gross section, both were highly vascular, while the bands of connective tissue so prominent in spleens in Class C, were notable for their absence.

Microscopic examination of the spleens from these two cases shows in both an enormous increase of the lymphocytes of the parenchyma, with a relative thinning of the

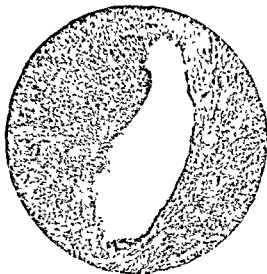


Fig. 2 Case No. 2 Splenic anaemia Lymphoma type Spl Sec x100, vessel invaded



Fig. 3 Case No. 2 Splenic anaemia Lymphoma type Spl Sec x100 lymphosarcoma

stroma and with no material proliferation of the endothelium of the venous sinuses. The lymphoid elements have so increased and so pressed upon adjoining structures as to obliterate all evidence of the Malpighian corpuscles, and, to a great extent, of the venous sinuses (Fig. 1). Besides the increase in the numbers of the lymphocytes, we find a large proportion of them swollen beyond their normal size. This condition of lymphocytic hyperplasia is so marked as to strongly suggest a neoplastic condition. In Case 2, several sections show blood-vessels (Fig. 2) whose walls in limited areas have been so infiltrated with lymphocytes that almost no fibrous tissue can be discerned within them.<sup>1</sup> Sections from areas near the hilum of the spleen from this case also show extensive infiltration of connective tissue bands by lymphocytes (Fig. 3). These two pictures were so marked that at operation a diagnosis of lymphosarcoma was made from the microscopic slides. A recent careful review of the slides made at the time of operation, and also of freshly made slides, confirms this diagnosis from the histological standpoint.

<sup>1</sup> A similar infiltration by lymphocytes of the arterial walls in the spleen of the normal bat has been noted by Downey and Weidenreich (57).

In the face of this picture however the fact remains that these patients, Nos. 1 and 2, who were operated on respectively five and one half and seven years ago, are both alive and well. It is thus highly improbable that any neoplastic growth existed outside the spleen in either case at the time of operation. When one considers the extent and character of the process in the spleen, it is difficult to conceive how a true lymphosarcoma, as we ordinarily define such, could have so long existed in so vascular an organ without the formation of metastases elsewhere. On the whole, then, it appears that we must materially modify our present concept of what constitutes a lymphoid hyperplasia, or, on the other hand, of what constitutes a lymphoma or lymphosarcoma, before we can place spleens of this type in either class. I am inclined to believe that while, in their final histological aspects, they may become true neoplasms (lymphosarcomata), both developmentally and clinically, their early stages represent only an extensive lymphocytic hyperplasia, with only a slight return of the cells to their primitive mesoblastic type. They certainly must be considered as quite distinct from such primary sarcomata of

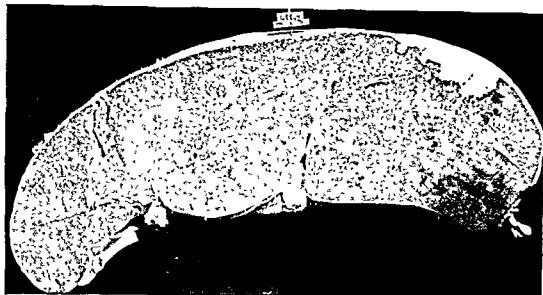


Fig 4 Case No 3 Splenic anemia Gaucher type Spl Sec mottled, marked fibrosis infarcted

the spleen as that reported by Jepson and Albert (18)

*Class B Primary proliferation of the endothelium of the spleen ("Gaucher type")* Our series contains three cases (Nos 3, 4 and 5), in each of which the spleen presents a picture the most striking characteristic of which is an enormous proliferation of the endothelium of the venous sinuses. Two of these are the largest spleens of our series, No 3 weighing 5280 grams 31 times normal (female), and the other, No 5, weighing 4500 grams, 26 times normal (female). The third No 4, weighed but 895 grams 5 times normal. All these spleens presented a rough exterior. The appearance of the sections, however, both gross (Fig 4) and microscopic of the three cases varies much.

Case No 3, which is a typical early "Gaucher spleen," will be described later in detail by Dr Franz Wildner of this laboratory, who had made considerable study of the case before the final compilation of the data in this paper was begun.

In Case 4 (Fig 5), the relative smallness of the spleen as compared with the other two cases of the class is readily understood on examination of the microscopic sections. There are only a few isolated areas of lymph-

oid tissue (Malpighian bodies). Almost all the venous sinuses are crowded with endothelial cells, closely resembling the pictures presented in slides from Case 3 (Fig 6). In many of the sinuses, some or all of the cells are shrunken and have lost their definite outlines merging into one another and thus showing that they are not only much pressed upon by the connective tissue, but also that they are in an early stage of degeneration. At the same time, surrounding the sinuses are broad bands of fibrous connective tissue, which give the appearance of having contracted and shut off the circulation from the endothelium of the sinuses. The giant cells in the venous sinuses in this case are so numerous as to have suggested the possibility of tuberculosis which, however has been excluded histologically and biologically. The process has apparently been an initial proliferation of the endothelium with a secondary connective tissue overgrowth, causing degeneration of the endothelium and a spleen which while still enlarged (five times normal), is yet not nearly so large as that in either of the other two cases of the class. This patient was quite well when last heard from, two and one half years after the removal of her spleen.

The spleen from the third case (Fig. 7) in

this class, No 5, is made up microscopically almost wholly of large spaces—apparently dilated venous sinuses—filled with what in most of them is a homogeneous colloid mass (Fig 8). In some of the sinuses, however remains of cellular elements can be made out while in a few these elements are still plainly shown to be endothelial cells (Fig 9). Surrounding these distended colloid-filled sinuses are broad bands of fibrous connective tissue containing here and there remains of lymphoid elements and not presenting the contracted appearance of the fibrous connective tissue in case No 4. The most reasonable interpretation of the pathological process in this spleen is that of a primary endothelial proliferation a secondary connective tissue increase, and a colloid degeneration of the endothelium.

While so far as I am aware no other observer has reported so extensive a colloid degeneration in a spleen of the Gaucher type it is probable that Marchand's (25) case was in a beginning stage of the same process since Marchand notes particularly the peculiar homogeneous hyalin appearance of many of the cells. It is possible, also that the fine linear markings on the endothelial cells to which attention was first called by Mandelbaum and Libman (12), and which were to be made out in all three of our cases, may mark early stages in the process of degeneration in these structures.

Weichselbaum's (1) case of "primary multiple endothelial sarcoma of the spleen" was the first case of this type to find its way into the literature. Though Weichselbaum omits all clinical data from the report of his case his description of the morbid histology leaves little doubt as to the character of the lesion. Gaucher (2) next described a case as "Splénomégalie primitive—Epithélioma primitif de la rate." Williamson's (3) case showed considerable fibrosis of the spleen, with "enormous numbers of large nucleated cells each containing six to ten red blood corpuscles" in the venous sinuses. Williamson's description is not as full as one could wish, and there remains considerable doubt whether or not his case was of this type. Collier (4) described the histological changes in the spleen of a case

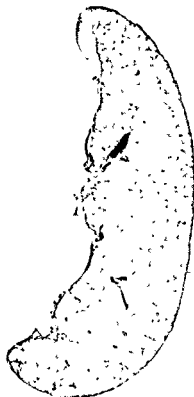


Fig 5. Case No 4. Splenic anemia. Late Gaucher type. Spl. sec. mottled.

as an endothelioma. His specimens, however were reviewed by the "Morbid Growths Committee" of the London Pathological Society who noted the enormous number of endothelial cells but thought the condition was not an endothelioma. Picou et Ramond (5) next described the lesions in the spleen from a case on which a successful splenectomy had been performed (the first in this group of cases). Bovaird's (9) cases were the first reported in America, and his thorough description of the pathology left little to be added by later observers. He was convinced that the essential lesion was an endothelial hyperplasia and not a neoplasm. Following Bovaird, Harris and Herzog (10) reported the first successfully operated case in America, and coincided with Bovaird that the chief histological change was an endothelial hyperplasia. The spleen in Rolleston's (13) case showed marked fibrosis and extensive endo-



Fig. 6. Case No. 4. Splenic anemia. Gaucher type. Spl. Sec. x100 diam. Beginning degree of proliferated endothelium giant cells and fibrosis.

thelial proliferation. Stengel's (17) case, that of a negro who had had more or less pain in the left side of the abdomen for many years and on whom splenectomy was successfully performed by Dr. Clark, presented a spleen whose surface was covered with numerous nodules from one to three cm. in diameter. Histologically there was enormous increase of the endothelium and fibrous connective tissue. There were many giant cells, and the endothelium so infiltrated the connective tissue that Stengel was convinced the condition was a true endothelioma. Histologically this case is apparently an exact counterpart of our case No. 4. Springthorpe and Stirling (19) reported six cases in one family, on one of whom a successful splenectomy was performed. They describe the morbid histology in the spleen as "a great increase of the fibrillar framework of the spleen pulp made up of anastomosing processes of endothelial cells with their rounded or elongated nuclei." The spleen in Umler's (20) case showed numerous deposits of pigment, the venous sinuses filled with blood and many large mononuclear cells with fine pigment granules; and many giant cells in the Malpighian bodies. Mandelbaum and Libman (21 and 31) have made thorough

pathological reports on two cases studied clinically by Brill. They were the first (21) to call attention to the peculiar linear markings to be seen with high power on the endothelial cells. They were also the first to call attention to the endothelial hyperplasia in the bone marrow. In their last report (31), following the suggestion of Schlagenhauer (24) and Marchand (25), they concede that the large endothelial-like cells may arise from the normal endothelium or from normal reticulum. Judging from the cuts illustrating Mandelbaum and Libman's articles, the endothelial cells are much more closely packed than in our Case 3, while the connective tissue increase is not as great as in our Cases 4 and 5. O'Malley and O'Malley (22) report their studies on the spleen of a case which had been operated, and describe an endothelial proliferation and a marked connective tissue hyperplasia throughout the spleen. Schlagenhauer's (24) case like that of Gaucher, was complicated with tuberculosis. He concludes that the disease is a general one of the lymphohematopoietic system and thinks it is analogous to lymphosarcoma. He doubts the endothelial character of the large cells filling the venous sinuses, and suggests that they may be derived from the reticulum. Marchand (25), in the examination of the spleen from one case, notes especially the hyaline appearance of the endothelial cells, saying that it suggests an amyloid degeneration. He is in doubt as to the origin of these cells, but says they may arise either from the endothelium or from the reticulum.

Krompecher and von Herzfel (23) in the study of one case conclude that the spleen was the seat of an inflammatory process or a benign new growth and are inclined to the latter opinion. de Jong and Van Heukelom (35), in the study of a spleen from a case which recovered after operation, decided that the cells in the venous sinuses had arisen from the reticulum, though they note that the possibility of an endothelial origin cannot be denied. The liver in their case continued to enlarge after splenectomy and they attribute this to a proliferation of the cells previously carried there from the spleen, though of course, this is speculative. Rettig (32), Risel (33) and

Plehn (34) have also contributed to the literature of this type of splenomegaly. The most recent report is by Mandelbaum (38) who reports a case of a boy  $4\frac{1}{2}$  years old who died the next day after splenectomy. The spleen weighed 490 grams. Autopsy showed the liver and all mesenteric and retroperitoneal lymph nodes enlarged. After a careful study of the histology of this case, Mandelbaum concludes "It is impossible to deny that a close relation exists between the reticulum and the large cells even though one cannot find evidences of transition stages between them."

From my review of the cases presented in the literature and a careful study of the spleens from our own three cases it seems to me that our best interpretation of the histological pictures presented is that of a primary endothelial proliferation with a secondary proliferation of fibrous connective tissue and ultimately a degeneration of the endothelium with contraction of the connective tissue. The survey of all the cases suggests a close analogy in their histology with what one meets with in hyperplasias of the thyroid and of the prostate, namely an initial hyperplasia of the parenchyma filling the acini, a secondary increase of the stroma and ultimately a degeneration of the parenchyma with contraction of the connective tissue.

With relation to the origin of the large endothelial like cells, they appear to me to be much more likely to have risen from the endothelium than from the reticulum. In this connection, it may not be amiss to recall that, though embryologically the spleen arises entirely from the mesoderm, yet soon after the first appearance of the splenic anlage, as a thickening of the dorso-mesogastrium, the coelomic epithelium covering it becomes arranged in multiple layers, the deeper ones of which change to mesenchymal type and become scattered throughout the spleen.

It seems to me unfortunate that the trend of medical thought was originally directed toward the consideration of these endothelial proliferations as true neoplasms, with the associated dread of malignancy, since it has no doubt operated to prevent surgeons from hazarding splenectomy, though, of the nine



Fig 7. Case No. 5. Splenic anemia. Late Gaucher type. Spl. Sec. mottled. Colloid deg. and adv. fibrosis.

cases which have been operated on as reported in the literature, four have recovered, while the remaining five were in very bad condition before coming to operation.

*Class C. Primary (chronic) diffuse hyperplasia of the spleen (chronic splenitis).* In this pathological class are found 13 of our cases (Nos. 6 to 18). The spleens are all large, weighing from 425 grams (two and one half times normal) to 1670 grams (nine times normal), with an average of 1089 grams (six times normal). The external surface of these spleens varies in roughness directly in proportion to the development of connective tissue

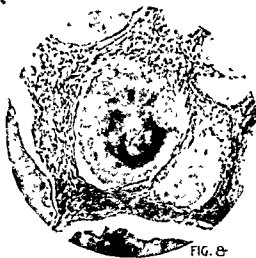


FIG. 8



FIG 9

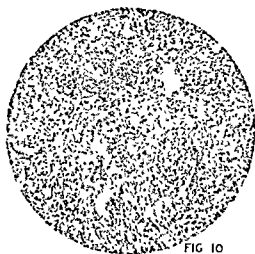


FIG 10

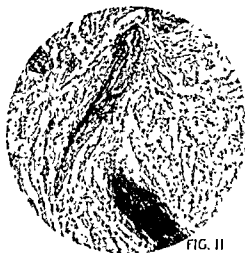


FIG. 11

Fig 8 Case No 5 Splenic anemia Late Gaucher  
type Spl Sec x100 Colloid deg  
Fig 9 Case No 5 Splenic anemia Late Gaucher  
type Spl Sec x100 Endothel remnants

Fig 10 Case No 13 Splenic anemia Spl Sec x100  
Chronic diffuse hyperplasia

Fig 11 Case No 8 Splenic anemia, with Banti's  
syndrome Spl Sec x100 diam Dilated capillaries and  
fibrosis

within the organ. On gross section, all of them show more or less fibrosis with dilated vessels. Microscopically, there is a diffuse overgrowth of all the tissue elements, lymphoid endothelial, and fibrous (Fig 10). In

several the lymphoid tissue is markedly increased, in most the connective tissue increase is very prominent, and in almost all there is some proliferation of the endothelium of the venous sinuses. In all of the cases with

marked connective tissue overgrowth, there is more or less sclerosis and atrophy of the pulp and Malpighian bodies. The latter frequently also show some hyalin degeneration. In several of the cases (Fig. 11) in which the fibrosis is most marked, dilatation of the capillaries and arteriosclerosis are also present. This process is especially marked in three cases which presented clinically the syndrome of Banti's disease and showed cirrhosis of the liver at operation. The pathology of this type of primary splenic anemia has been so well described by Banti (6), Sippy (7), Osler (8 and 36), Wentworth (11), Warthin (16), Marchand (15), Simonds (26), Lyon (27), and others, that further description is unnecessary. The picture is that of primary chronic diffuse parenchymatous and interstitial inflammation. Whether this process is the result of a local micro-organismal invasion or of a locally acting toxin is undetermined, though hypothetically the latter is the more probable.

*Group II Cases with a Doubtful Clinical Diagnosis Falling between Splenic Anemia and (a) Infection, (b) Pernicious Anemia, or (c) Hepatic Cirrhosis*

In this clinical group are four cases (Nos. 19, 20, 21 and 22), on whom splenectomy was done, and one autopsy case, No. 23, and yet in whose histories the element of infection was so prominent as to make doubtful the clinical diagnosis. The spleens in these cases, while enlarged, are relatively smaller than those in the preceding group, ranging from 320 grams (two times normal) to 1,340 grams (eight times normal), with an average of 800 grams (four and one half times normal).

In one of these cases, No. 19, the spleen which weighed only 320 grams, shows only an increase of the parenchyma without endothelial or connective tissue proliferation. In this case, not only were the clinical data insufficient on which to base the diagnosis of splenic anemia, but the pathological picture was also not that of the other clinically well-defined members of the group. The patient, however, is alive and well, about two years after operation.

In Case 20 the spleen, weighing 640 grams, was soft and showed an increased parenchyma and some increase of connective tissue. There was evidence of old and recent hemorrhage in the numerous infarcts and areas of blood pigment. This case presented clinically a widespread infection of the upper abdomen and there is little in the pathological picture of the spleen to suggest its relationship to splenic anemia. The patient died about six months

after operation with symptoms of nephritis and general infection.

In Case 21 the spleen weighed 900 grams, with a rough, nodular exterior, and showed on section dilated vessels and marked fibrosis. Microscopically, the fibrosis was found to be quite diffuse, the lymphoid elements proliferated, and there was also some proliferation of the endothelium of the venous sinuses. This case was complicated clinically with a doubtful history of tuberculosis and syphilis. Pathologically, one could not distinguish it from members of Group I, clinically splenic anemia. The patient died, two months after operation, of nephritis complicated by pleurisy with effusion.

Case 22 had had Raynaud's disease five years before operation and gallstones were found at operation, at which time also a 1,340-gram spleen was removed. The surface was rough, hard, nodular, and on section showed a marked fibrosis. Microscopically the fibrous overgrowth is found to be diffuse, the venous sinuses shrunken, with no endothelial proliferation, and there is no marked hyperplasia of the lymphoid elements.

Case 23 was a male 25 years of age who had been sick for two years. At the time he was examined, a few weeks before his death, he presented an enlarged spleen with a red blood count of 2,900,000, a leucocyte count of 5,200 and hæmoglobin of 67 per cent. Later his leucocyte count went up to 13,000. His color index was always one or above. This patient came to autopsy, without operation, through an intercurrent lobar pneumonia. Aside from the pneumonia, the liver was found slightly enlarged and fatty and there was some chronic nephritis. The spleen weighed 1160 grams (six times normal). It was smooth, mottled on gross section, firm, and fibrous. Microscopically, there is a very marked fibrosis and the venous sinuses are dilated, but without any marked proliferation of the endothelium.

In the list of cases with a doubtful clinical diagnosis of splenic anemia are two which a fuller clinical review seems to place in a group of atypical pernicious anemias. The first of these, Case 24, was a male age 27 years. Splenectomy, February 9, 1910. The spleen weighed 1640 grams. It was smooth, evenly marked, showed but a slight increase of fibrous connective tissue, but an enormous amount of blood pigment and debris of broken-down blood cells. The patient died six months later without any material interruption having been made in his chain of symptoms by the operation. The pathological findings in this case suggest pernicious anemia.

Case 25, on whom a doubtful clinical diagnosis of splenic anemia or pernicious anemia was made, was that of a child 10 years of age, who was in a moribund condition when brought to the hospital and who died two days later without operation. His blood picture presented some of the characteristics of pernicious anemia (r.b.c., 1,013,000; leuc., 13,000; normoblasts, megaloblasts, myelo-



... polycythosis; hæmoglobin 15  
... there had been recurrent hæmor-  
... bowels for a year. At autopsy,  
... areas of submucous hæmorrhage  
... large and small intestines, the only  
... condition found was a spleen three  
... size, pale, hard, and fibrous, and a  
... liver which was light in color and  
... cally, the spleen showed a thickened  
... very advanced fibrosis and almost  
... of lymphoid elements. When stained  
... spleen nor liver showed the deposit  
... cases of pernicious anæmia

... a female 20 years of age on whom a  
... diagnosis of splenic anæmia was  
... operation, February 26 1912, the  
... a diagnosis of probable primary  
... liver. A spleen weighing 750 grams  
... The patient died two months after

#### II Cases of Splenectomy for Conditions of Splenic Anæmia.

... was a female, age 29 years, on whom a  
... osis of painful wandering spleen was  
... ectomy was performed January 22,  
... spleen weighing 170 grams and apparently  
... respects was removed

... was a female, age 29 years, on whom a  
... osis of painful wandering spleen was  
... ectomy was performed June 27 1908  
... weighed 145 grams and showed a some-  
... red parenchyma, but was otherwise

... was done in both of the above cases  
... of pain, and was successful in both

... thus be seen from this brief descrip-  
... the above eleven cases that three (Nos  
... and 25) which were clinically doubtful  
... anæmias were indistinguishable patho-  
... from those cases on which the clinical  
... were positive. However, Case 21  
... doubtful history of associated tubercu-  
... Case 23 of an intercurrent infection  
... ), and Case 25 was a child and  
... moribund when first examined at

#### GENERAL SUMMARY

... Pathological study of 18 spleens re-  
... at operation in the Mayo Clinic from  
... 14, 1905, to November 1, 1912,  
... patients on whom positive clinical  
... of splenic anæmia had been made,  
... that in each spleen there was hyper-  
... of one or more of the constituent tissue  
... In two spleens, the lymphoid tissue

was so markedly overgrown as to suggest a  
diagnosis in one of lymphoma and in the other  
of lymphosarcoma. In three spleens, the pro-  
liferation of the endothelium of the venous  
sinuses was most predominant. In 13 spleens,  
the process was a chronic diffuse one involving  
all tissue elements.

2. While any case of primary splenomegaly  
may begin as an overgrowth of the lymphoid  
tissue or of the endothelium, in the ordinary  
course of events a secondary overgrowth of  
the stroma of the gland will later appear,  
accompanied by degeneration of the lymphoid  
or endothelial elements

3 The largest spleens are those in which  
the lymphoid or endothelial hyperplasia is  
greatest. As the connective tissue overgrows,  
the spleen may be reduced in size owing to  
reduction in the amount of the lymphoid and  
endothelial elements.

4 The roughness of the exterior of the  
spleen is in direct proportion to the develop-  
ment of connective tissue within it.

5 In primary splenomegaly, a secondary  
cirrhosis of the liver is associated with great  
connective tissue overgrowth and degenera-  
tion of the pulp of the spleen

6 From what we know of hyperplasias in  
other organs it would seem unnecessary to  
assume hypothetically the presence of three  
different causes for the production of the three  
primary histological types of splenic anæmia

7 The histopathological picture presented  
in all three types of spleens from cases of  
primary splenic anæmia seem to be in com-  
plete harmony with the hypothesis of the  
presence of a slowly acting local toxin

8. There are certainly spleens from clinical-  
ly doubtful cases of splenic anæmia which the  
pathologist cannot distinguish from the  
spleens from clinically undoubted cases. Yet  
it must be conceded that the finding of a great  
hyperplasia of one or all of the tissue elements  
of the spleen, without other diagnostic lesions  
elsewhere in the body, is strong corroborative  
evidence of the clinical diagnosis of splenic  
anæmia.

In conclusion I wish to thank Dr. Franz  
Wildner of this laboratory for the use of  
sections from some of the cases, prepared  
under his careful direction, and which will be

more fully described by him in an early forthcoming article on certain features of the pathology of the spleen. I am also under obligations to Dr. H. Z. Giffin for the clinical notes which he has so kindly supplied

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THE EXTENDED ABDOMINAL RADICAL OPERATION FOR CANCER OF THE UTERUS<sup>1</sup>

By WILLIAM WEIBEL, M. D., VIENNA  
Assistant to Professor Wertheim

THE history of the radical abdominal operation for cancer of the uterus was inaugurated by W A Freund, who began systematically in 1878 with the abdominal route for the extirpation of the cancerous uterus. But the mortality of this operation was so enormous that it was abandoned very soon in favor of the vaginal methods. Afterwards taken up again, the abdominal method made considerable progress, when Rumpf dissected first the ureters, Ries proposed the removal of the pelvic lymphatic glands, and Clark exposed the ureters in ten cases for the purpose of removing as much as possible of the parametria.

Such a state of affairs Wertheim found when he began, in 1898, instead of Freund's operation, to elaborate a radical method relying upon modern surgical principles, which should be able to remove not only the cancerous uterus but also the pelvic connective tissue and the regional lymphatic glands.

These two points characterize the radical operation: widest excision of the parametria and removal of the pelvic glands. And, what is to be mentioned as a very important point: in order to get out as much parametrium as possible, one has to expose the ureters and to push them far away as a preventive measure.

The technique of the operation is as follows:

<sup>1</sup> Read before the Clinical Congress of Surgeons of North America, New York City, November 14, 1912

Scraping and cauterizing of the cancer immediately before the laparotomy without anesthesia, in order to save the patient's heart. Trendelenburg's position Incision in the median line, wide separation of the bladder from the uterus and the vagina, tying of the lig inf pelv and rot Dividing the two layers of the broad ligament The ureter is to be exposed up to the entrance into the parametrium without isolating it Here the ureter is crossed and covered by the uterine vessels The index finger is pushed through the parametrium between ureter and vessels, thereby isolating the uterine vessels By these means, the ureter is protected during the ligation of artery and vein By this procedure the whole pelvic portion of the ureter becomes so accessible that it is easy now to complete the separation of the ureter Separation of the rectum from the vagina is the next step

Wide excision of the parametrium, after having put on bent clamps for the avoidance of hemorrhage Two strong right-angle clamps are now applied to the already isolated vagina so that the cancerous tissue is completely enclosed, thereby preventing its coming in contact with the wound after the opening of the vagina

The next step is the removal of the lymph glands They lie along the common iliac, the external, and the hypogastric iliac, and in the trigonum between both, also downwards to the obturator foramen and high up as far as the division of the aorta We never search higher than this point for glands and extirpate only enlarged ones for we never found cancer in glands of normal size

The pelvic wound is always drained by iodoform gauze and the peritoneum is closed carefully. But if there is not enough peritoneal material or if this is infected, we refrain from the complete closing of the peritoneum

The ureter plays an important rôle in this operation. By freeing it from the parametrium it is not always possible to avoid injuries, isolations, or even lesions It is often necessary to dig the ureter out of the cancerous infiltrated parametrium, so that the uterus shows afterward a deep sulcus, representing the place where the ureter was fixed Some operators prefer to resect the ureter, when it

is firmly fixed, without losing the time required to dissect it out; they consider it the only proper way to operate radically. But the microscopic examination of the resected ureters shows that the cancer involves the ureter wall very seldom and very late We always prefer to dissect the ureters, even in the most advanced cases, and the number of our resections with implantation in the bladder is therefore small — only 1.5 per cent of all cases operated on. The control of the cases with fixed ureters operated in this way convinced us that our method is right, because we found many of such cases free from recurrence. It is a fact that the nourishment and function of the ureter is sometimes disturbed in spite of all care used during the operation, for the ureter can be isolated, displaced, and bent as the result of the operation. In about 6 per cent of all our cases we got a ureterovaginal fistula, coming in the second or third week after the operation through secondary necrosis of the ureteral wall Such fistulae closed themselves spontaneously in 60 per cent; the other cases, surviving the operation, got an ascendant infection with the well-known consequences and complications. Operative treatment is here unavoidable, and we prefer nephrectomy to the implantation of the ureter into the bladder But also without fistula, ureter and pelvis of kidney can be infected as a consequence of the injuries of the ureteral wall during the operation Many of these cases running a little temperature in the first weeks after the operation are afflicted with ureteritis and pyelitis

The bladder is often involved by cancer and fixed to the uterus; in such cases the preparation gives difficulties, and it is not always possible to avoid injuries and lesions of the bladder Here we recommend resections of the bladder, because they are only small complications of the radical operation in contrast to the resection and implantation of the ureters

Very seldom the rectum is affected by cancer, and in only a few cases we found it necessary to resect the rectum.

A very important point is the question of the removal of the glands, and a success from the extirpation of the cancerous glands must

be a victory of the abdominal method, since it is impossible to remove the glands by vaginal route. In 25 per cent of all cases we found cancerous glands, and nearly all of these died from recurrence. Notwithstanding, we adhere firmly to the principle of removing cancerous or suspicious glands, and we have now ten cases with cancerous glands being free from recurrence more than five years after the operation. These cases could surely not have been cured if they had been operated by vaginal route.

A point of great importance is the anaesthesia. If it is a general narcosis, it must be as short as possible. In every case not suitable for general narcosis we use spinal anaesthesia, or we mix chloroform and ether with oxygen in Roth-Draeger's apparatus.

According to this plan, from 1898 to 1912 we operated 675 cases of cancer of the cervix, the cases of body cancer are not included, being anatomically and clinically quite different from the cervix cancer.

All together, during these fourteen years 1,430 cases of cervix cancer were examined in our clinic, 71 of these refused the proposed operation, 684 were inoperable, and 675 were subjected to the radical abdominal operation. Consequently we have, on an average, 50 per cent operability. The operability raised from 42 per cent under the first 150 cases to 52 per cent in the third to fifth hundred, and amounts now to 55 per cent under the last 175 cases. In regard to the indication for the operation, it is very difficult to explain exactly when a case of cervix cancer is to be called inoperable. We have to consider the infiltration of the parametrium, the fixation of bladder and rectum, enlarged glands on the pelvic wall compacted together and eventually palpable through the abdominal wall, and, as a very important point, the general condition of the patient, especially the condition of the heart, cachexia, and the age of the patient.

In some advanced cases one determines to a certainty whether an operation is possible or not only by the exploratory laparotomy. First we palpate the glands on the pelvic wall; if these are large, fixed, hard masses adherent to the big vessels, and if they are located high up along the aorta, the case is inoperable —

the uterus may be movable or fixed. Dilatation of the ureters is no contraindication for the operation, but it is a sign of bad infiltration in the parametrium and makes a resection of the ureters sometimes necessary. Naturally, fixation of bladder and rectum is an unfavorable symptom.

If the uterus is left behind, the operation is to be considered an exploratory laparotomy and the case is inoperable, but if the uterus is removed, the case must be classed as radically operated.

The greatest detriment to Freund's operation, and afterwards to every other abdominal method, was the high primary mortality. Really our first hundred cases gave a mortality of 30 per cent, but this number was constantly reduced, amounted in the fifth hundred to only 15 per cent, and is now, under the last 175 cases, just 9 per cent, including every death in any manner connected with the operation. The women died mostly of peritonitis, paralysis of the intestine, degeneration of the heart, embolus and pyelonephritis — seldom from other complications.

This excellent effect of our efforts to diminish the danger of the operation was not attained by an especially critical selection of the operated cases, it is a success of continually improving the technique and of the correct use of the anaesthesia.

Every rise of the operability is connected with an increase of the mortality, and operators with the astonishing number of 80 per cent or even 90 per cent operability report a mortality of 20 per cent and more. Our operability is much smaller than the operability of many other men because our material is especially bad, and we refuse to operate cases which are absolutely hopeless for permanent cure.

Our standpoint in this question is established by Wertheim as follows: We see the possibility of improving the after-results in the most exact performance of the operation, but not in the raising of the operability. And the most exact performance of the operation can be attained without increasing the mortality.

We could not find that particularly young age or pregnancy simultaneous with the can-

cer of the cervix, had an unfavorable influence on the prognosis.

In regard to the recurrence, we found nearly all these in the glands on the lateral pelvic wall, seldom local recurrences in the vaginal scar and in the bladder.

We don't expect much of operations for recurrences, and we did just a few operations of this kind.

In criticising the results of an operation for cancer of the uterus it is necessary to control the cases at least five years after the operation, and we are not allowed to consider a case cured before these five years have elapsed.

Of our 675 cases, 380 are now, at the end of five or more years since the operation, so that we can use them for criticising the value of Wertheim's method. During the same time in which we operated these cases, we examined in the clinic 863 cases of cervix cancer, of which 36 refused the proposed operation. 447 were inoperable, and 380, as mentioned, were subjected to the radical operation. Eight of these 380 died from intercurrent diseases, and 160 were well and free from recurrence at the end of five years. Just one case was lost sight of. In criticising the value of the operation, one has two points of view.

1. We have to calculate how many of all cases subjected to the radical abdominal operation are free from recurrence at the end of five years. We call it after results.

2. We have to calculate how many of all cases examined in the clinic (including the inoperable ones) are well and free of cancer at the end of five years. We call it absolute efficacy (absolute percentage of cures).

In the second calculation, the operability has an important influence on the permanent results.

Cancer statistics are then only good if you

can determine the condition of all operated cases. If a case is lost sight of, you have to consider it as a recurrence. If a case died from some intercurrent disease in no way connected with the primary cancer, you have to deduct it; if you can't exclude this connection, you have to put it to the recurrences.

We calculate our after results as follows: 380 were operated, 8 of these died from intercurrent diseases and 160 were well and free of recurrence; therefore we could permanently cure 43 per cent of all operated cases. If we leave the primary deaths out of the calculation (because they can't come into consideration with respect to the after results), we have 53 per cent permanent cures of all cases surviving the operation.

Calculating the absolute efficacy we get the following results: 863 cases with cancer of the cervix were examined in this five-year period, 36 of them refused the proposed operation, and 8 died from intercurrent diseases; from the rest (819) 160 cases were well and free of cancer. It is 19.5 per cent absolute efficacy, 1 per cent more than we had in the first 250 cases.

With these results we can say that the radical abdominal operation for cancer of the uterus cured permanently a fifth of all these cases we examined in the clinic; it cured permanently 43 per cent of all operated and 53 per cent of all cases surviving the operation. In the last 175 operations we have been able to reduce the primary mortality to 9 per cent.

The raising of the operability, the permanent falling of the mortality, and the increasing improvement in our operative technique allow us to hope that we will be able to report much better results in the next years, when our present cases will have passed the five-year period.

THE RADICAL ABDOMINAL OPERATION FOR CANCER OF THE UTERUS<sup>1</sup>

BY JOHN G. CLARK, M. D., PHILADELPHIA

SINCE the inauguration of a more radical operation for cancer of the uterus, surgical critics have been ranged on one or the other side of the question as energetic antagonists or ardent sponsors. With such a radical operation it is inevitable that the primary mortality must be high, the surgical accidents and sequelæ numerous and more or less distressing; and even among the most optimistic advocates the consensus of opinion has been that unless the percentage of permanent cures is to be considerably increased, it must be abandoned in favor of less hazardous procedures. To Wertheim belongs the credit of having actively carried forward and simplified the technical details of a more radical operation suggested by Riess, Rumpf, and myself. From the first report of his smaller series of cases until the recent appearance of his monograph covering five hundred completed histories, his efforts have been persistent, even in the face of a very high primary mortality. His final conclusions are incontrovertibly in favor of the operation as executed in his own hands and those of Zweifel, Kronig, Bumm, Frantz and others. While these results have been obtained by a few specialists with a very abundant clinical material, they are not likely to be duplicated, because of technical difficulties by those of lesser opportunities. Even in Wertheim's series of five hundred cases the primary mortality is shockingly high, being followed in his first hundred by a thirty per cent death rate, in his second hundred, by twenty-two, while, even in his fifth hundred, it was still as high as fifteen per cent. Certainly, this is not an encouraging outlook for men of lesser opportunities to contemplate. It matters not for what an operation is performed, there are but few surgeons in America so temperamentally constituted that they can work ahead with great enthusiasm in the face of primary mortality of one in four, or twenty-five per cent, and further, to see the survivors

pass through the trying ordeals of a stormy convalescence, attended with many grave post-operative sequelæ. In the radical operation, it is only through the development of a most perfect technique that the hazards of death and serious surgical accidents may be diminished to even a moderate degree.

It is particularly opportune that this question has been brought before the American Gynecological Society for discussion; for it is now more than a decade and a half since the radical operation was first proposed, and statistics sufficiently comprehensive should be available to help us in deciding whether it offers a sufficient increase in permanent cures to justify its adoption by the great rank and file of surgeons of this country. The universal benefit of any medical or surgical measure cannot be great if its execution is so difficult as to render it highly hazardous except in the hands of a very few specialists.

My experience, so far as permanent cures are concerned, has not thus far sustained my hopes for greatly improved results; yet the criticism of my efforts may possibly be the same as that offered by Wertheim in commenting upon von Rosthorn's first series of cases, which was attended with a comparatively small primary death rate, but a high percentage of recurrences—namely, that this indicated a failure to really effect a widely extended excision of parametrium and vagina. With increasing enthusiasm for the principles underlying this operation, von Rosthorn became still more radical and his mortality quickly increased to a much higher rate; and although he believed that the survivors would show a proportionally greater freedom from recurrences, Schottlander's and Kermanner's recent review of his cases do not brilliantly sustain this anticipation.

In Cullen's comprehensive monograph (*Cancer of the Uterus*, 1900) the cases of cancer of the uterus operated upon in the

<sup>1</sup> Read before the American Gynecological Society, Baltimore, 1912.

Johns Hopkins Hospital by various methods were reviewed, and, so far as possible, the post-operative results were accurately determined. My first case was operated upon in the Johns Hopkins Hospital by a more radical method in June, 1895, and during the next year and a half twelve cases were subjected to this measure with more or less technical variations. Through Dr Kelly's generous desire to give me every opportunity to elaborate this plan, several cases were turned over to me for operation.

In all, there were twelve, in some, the glands were removed, in others, there was only a wide excision of a vaginal cuff and as much parametrium as possible. There was one operative death. Among the survivors, four could not be traced, one died in three months, one in nine months, one in ten months, one in thirteen months, and another, four years after operation. Two were alive at the time of publication of Cullen's book, without evidence of recurrence, three and a half years after operation.

Of this series, therefore, we can only assume that the last two cases may be cured. According to continental statisticians, the cases that cannot be traced must be counted among the failures. This rule makes it impossible to reach any definite conclusions as to accurate final results in our larger American cities; for the perfect system of police registration in the continental municipalities does not obtain with us, and it is rarely possible to follow patients after they have changed their address twice. This has been noted in the futile attempts to trace several of my cases operated upon in the Hospital of the University of Pennsylvania.

The failure to obtain better results in this first series of cases, and others subsequently operated upon in Philadelphia, casts doubt upon the efficiency of this more extensive procedure, and, while I still adhered to the principle, I felt that I had either applied the operation to too far advanced cases or that there had been a failure to really effect the widest possible excision of locally involved tissue. With increasing experience, the difficulty and even the impossibility of really executing a truly extensive glandular dissec-

tion caused me to abandon this attempt; for, it unduly lengthened the time of the operation with a coincident increase in primary mortality, as well as an increase in operative mishaps and post-operative complications. Hence, I confined my efforts to the widest possible excision of the parametrium, with as large a vaginal cuff as possible, contenting myself with the removal of one or more glands, if palpably enlarged, for prognostic purposes. My conviction was based upon the following points:

- 1 The absence, as yet, of any known law concerning metastasis, for, as already demonstrated, the glands of the side of greatest local involvement may be free, while the parametrium, or higher glands of the opposite side, may show microscopic foci.

- 2 The unreliability of the microscopic appearance of a gland in determining metastasis; for, a large, palpable gland may be removed painstakingly from the bifurcation of the iliacs, and prove to be of an inflammatory character only, while an invisible lymph radicle or a microscopic focus, immediately adjacent, may be the lodgment place for cancer cells.

- 3 The absence of any law as to what type of case gives metastasis. A very limited local process may show wide glandular metastasis, whereas the opposite may be true in the extensive involvement.

- 4 The peculiar distribution of metastasis in that occasionally a lower group of glands may escape metastasis, whereas those above are involved.

Concerning the question of glandular extirpation, it now appears evident that if the higher pelvic lymphatic system is the seat of metastasis, it is scarcely possible for the widest and most painstaking dissection completely to eradicate it. That this forecast has been sustained is shown in Wertheim's report; for, in his large series of cases that had passed over the five-year period, there were only five survivors in whom the lymphatic glands were involved at the time of the operation. All of the rest are dead. I am aware of the earnest contention in favor of this part of the operation by Aulhorn, Mackenrodt, Rises and others, but, in view

of the objections just noted and in the face of the failure of the advocates to sustain their position by a much higher percentage of cures in the cases of glandular metastasis, it is self-evident that at the worst we are making but a slight error in this limitation, which will be offset by a lesser primary death rate.

In a monograph of nearly eight hundred pages<sup>1</sup> by Schottlander and Kermanner are detailed in extenso the cases of von Rosthorn in his clinics at Graz, Heidelberg, and Vienna, comprising in all 256 abdominal operations, distributed as follows: Graz, 85, Heidelberg, 77, Vienna, 94. In the first series of twenty-seven cases that came under the five-year period, there were 20 per cent cured. Of the remaining fifty-eight, 24.1 per cent died from the primary effects of the operation, one died of intercurrent disease, and eight could not be located, leaving eighteen alive over two and one half years after operation. Von Rosthorn's experience with the radical operation in the Graz Clinic was very unsatisfactory. In his laudable desire to give the fairest trial to this operation, he attributed his failure to effect more cures to the fact that he had not excised a sufficient cuff of the vagina.

Upon assuming the directorship of the Heidelberg Clinic, he endeavored to correct this defect, and at once noted a very decided increase in primary mortality; and, although there was a larger percentage of permanent cures among the survivors, the final results, reckoned from the standpoints of primary mortality plus subsequent deaths from recurrence, were only slightly better than with the less extensive operation in Graz.

After von Rosthorn was called to the University Clinic in Vienna, ninety-four cases were operated upon. Ten died from the primary effects of the operation, leaving eighty-four for final study. At the time of publication of Schottlander's and Kermanner's monograph, there had already been noted twenty-four recurrences. The remainder cannot be utilized in considering permanent cures, be cause of the short time since the operation.

In such a radical procedure, very serious surgical accidents occur, which may so far militate against it as to raise the question as

to whether the game is really worth the candle. The study of cases of cancer, therefore, should not be based alone upon mortality statistics, for the prolongation of life with some wretched operative complication hardly justifies the salvage.

Thus, in von Rosthorn's entire series of 256 operations, the bladder was more or less seriously injured in forty-one cases (16.41 per cent). The majority of these fistulae were repaired at the time of the operation, but several remained more or less permanent for some time. Four required subsequent operation, and eleven remained permanently patulous. In 6.25 per cent there were injuries to the ureters. In 3 per cent there were lacerations of the rectum, and in one case the obturator nerve was cut, causing permanent crippling of the leg. Secondary necrosis of the bladder occurred during the convalescence in 6.25 per cent of cases. Secondary ureteral fistulae were noted in 7.03 per cent of cases. Other complications, such as intestinal fistulae, etc., are recorded in a small percentage of cases.

In concluding this review of von Rosthorn's cases, Schottlander and Kermanner do not reach a positive conclusion as to the final value of the radical operation, reiterating the conservative opinion expressed by von Rosthorn in one of his earlier papers published in 1906, as follows: "We do not wish to overvalue, nor yet to undervalue, the radical abdominal operation, for we are still in the beginning of its development." Von Rosthorn further stated that, theoretically, this procedure offered the most effective possible way thus far suggested of reaching the best results, but it would still require a long time to arrive at final conclusions as to whether these principles, when carried into effect, really will be justified by better results than the less hazardous methods hitherto in vogue. The latest results and the most favorable of all so far as permanent cures are concerned, are those of Kronig, reported by Busse.<sup>2</sup> He gives in more or less detail the results of 59 operations by Kronig in Jena, with 25.3 per cent ultimate cures.

<sup>1</sup> Zur Kenntnis des Uteruskarzinoms 1912

<sup>2</sup> Ueber Dauerresultate bei der Operation des Uteruskarzinoms nach den abdominalen Methoden. Monats f. Geburts u. Gynäk., Jan., 1912



after the five-year period, reckoned according to Waldstein's formula. Kronig has been very radical in advanced cases, with a very high primary mortality; but the increased percentage of cures may justify his query as to whether we may not hope to reach the best ultimate results by the most radical operation in even the very far advanced cases. Before taking this view, however, we should weigh other considerations, which I shall mention later. His experience in Jena causes him to advance his standard to the very extreme of operability, and he believes that even Wertheim is too conservative in this particular.

In attempting to reach a final estimate of the value of the radical operation, one must compare carefully all reports from authoritative sources on other operations. Thus von Ott,<sup>1</sup> who is recognized as a very skillful technician, compares the radical abdominal, the radical vaginal, and the simple vaginal hysterectomy. He believes that an estimate of the value of the three methods should be founded not alone upon the number of the patients which are permanently cured, but also upon the immediate danger which is associated with each method. The crux of any ideal operation is a small primary mortality, freedom from operative accidents and post-operative sequelæ, and the highest percentage of permanent cures.

In weighing statistics, he compares Wertheim's radical abdominal operation, Staude's and Schauta's radical vaginal method (Schuchardt's operation) and his own, the simple vaginal method, as follows:

	Radical Abdominal Method Wertheim	Radical Vaginal Method Staude	Radical Vaginal Method, Schauta	Simple Vaginal Method v. Ott
Cases operated upon for five or more years	116	58	47	191
Deaths following opera- tion	27	9	9	4
Mortality (percentage)	23.3	15.5	19.1	2.1
Absolute percentage of cures (1) (interleaved operation method)	71.7	73	77	75.5
Absolute percentage of cures according to Waldstein	19.16		13.5	15.1

From this table, it is quite evident that although the abdominal radical operation carries an exaggeratedly higher mortality, in the final casting up of accounts, the

permanent cures, although very decidedly better, exact a very high primary death toll.

In comparing the Schuchardt method, as executed by its exponent Schauta, with the radical method of Wertheim, we may say with great certainty that its value, as demonstrated in Schauta's hands, has fallen short of the standard set by the latter. The cures reported by Wertheim are 57.6 per cent while Schauta's were only 38.2 per cent. From a comparison of these statistics, it is evident that the Schuchardt method will never have many exponents; for it requires quite as much skill, is attended with a high primary mortality, and is followed by a very large percentage of post-operative accidents.

Further, it bears the serious disadvantage, which all extensive vaginal hysterectomies bear, that the most critical part of the work is done under touch. Even in the hands of the average skilled operator, it would be attended by wretched consequences.

The primary mortality among German and Austrian operators varies widely, and there are wide divergencies in ultimate results. Thus the primary mortality among the leading exponents of the radical operation is as follows: Wertheim, 18 per cent; Zweifel, 8.5 per cent; Doderlein, 18.2 per cent; Bumm, 21 per cent; and Kronig, 25.4 per cent. Both Kronig and Wertheim claim that the high primary rate of mortality indicates the thoroughness of extirpation of the uterus, parametrium, and vagina, and criticise von Rosthorn's first series of cases because his death rate was only 6 per cent, and yet, as already pointed out, even von Rosthorn's later and more radical efforts did not bring a compensatory return. Now come the discrepancies which statistics so frequently show—Zweifel, who has a higher rate of operability than Wertheim, a ratio of 45 per cent by one as against 43 per cent by the other, had only 8.5 per cent primary mortality with a permanent salvage after five years of 20.46 per cent as against 18.4 by Wertheim.

These statistics confuse us, and we are naturally puzzled over these wide differences in the hands of men presumably of equal

ability. Certainly neither Wertheim nor Krönig are justified in criticising von Ros-thorn's bad results because his primary mortality was only 6 per cent when Zweifel, who operates upon 45 per cent of all cases applying to his clinic with only an 8.5 per cent primary mortality, claims a percentage of permanent cures decidedly better than Wertheim.

I have quoted rather extensively from the statistics of these leading gynecologists in Germany and Austria, for the radical operation has been more extensively carried out in those countries than in America.

If an operation, or other therapeutic procedure, is to have a permanent place in our armamentarium, it must be sufficiently easy to make it available, not for a few skilled specialists, but for the great body of surgeons working in every quarter of this and other countries. In these days of low primary percentages attending nearly all the major operations, no operation can possibly gain extensive headway which carries with it a shockingly high mortality and a large number of distressing and disabling sequelæ. Further, while the continental surgeon, with his large and overcrowded clinics, may ignore the question of mortality in working out a principle, the American surgeon, as well as the American layman, is so temperamentally constituted that the one cannot and the other will not disregard a high primary death rate except in operations of direst emergency. The effect upon the lay mind, therefore, must be taken into consideration, for while one may have over 50 per cent ultimate cures, the effect upon the average intelligent citizen is abhorrent if, for this number of survivors, there have been 25 deaths, and for the other 25 a wretched existence, attended by repulsive post-operative sequelæ, followed by a torturing and lingering death. We must remember that these cases are not rushed to our hospitals in extremis, but walk in apparently in perfect health. The very nature of their disease makes these women secretive, and their friends and neighbors seldom know of their illness until they hear that they have been operated upon. Even the survivors leave the hospital, and do not talk of their ill; in-

deed, they are usually kept in ignorance of its true nature. If they die, however, all know about the surgical tragedy. In other words, as I have parodied in another paper two lines in Mark Antony's funeral oration — "The evils of cancer operations live after them, the good is interred with their bodies." We have all seen the wide-spread prejudicial effects of a fistula among the circle of a patient's criticising friends. After all, the layman only counts as the final test of surgery, successful results, as represented by a restoration to health with a maximum percentage of surgical safety. The specialist therefore who may even save the largest number of cases may drive away many others through his unavoidable high death rate and surgical accidents incident to this salvage. With this view of the situation, no one should be censured who regards with favor von Ott's opinion — that an operation, such as a simple vaginal hysterectomy, with a very small primary mortality and almost no complications, is preferable when one casts aside the purely surgical consideration and takes into account the layman's estimate of results. The population with which we deal is quite different from the great stream of humanity flowing into the German and Austrian clinics, for there, the peasant population is usually ignorant and its afflicted members stoically accept their fate, whether it be good or bad. It is possible that when we make a final summary of our combined experience we may have to accept the conclusion that a less radical operation, even though it ultimately saves fewer cases, may be preferable when attended by a low surgical mortality and few or no operative sequelæ. What will be infinitely better and what we ardently hope for is that the present operation, which embodies correct principles, may be further improved and thus eliminate the high mortality now generally attending it. The gradual lowering of the death rate in many hands offers the forecast that we may yet achieve better results. If this follows, every argument will then be in favor of the radical operation until some other more effective means of combating this disease supplants it.

**SUMMARY OF CASES OF CANCER OPERATED UPON BY ABDOMINAL HYSTERECTOMY OF A MORE RADICAL TYPE IN THE GYNECOLOGICAL CLINIC OF THE UNIVERSITY HOSPITAL:**

In the study of my cases, I have included only those patients operated upon in the University Hospital, because the records of these cases are much more complete than those in other hospitals with which I am associated. Even here it has been impossible to trace all of these patients, thus leaving a considerable hiatus in the final summary of results.

In this review it will be seen that the operative accidents—such as fistulae, suppuration of the abdominal incision, etc.—have been about the same as those noted by other operators. Briefly summarized my results are as follows:

**CARCINOMA OF CERVIX**

Total number of cases	36
Operative deaths (peritonitis)	3
Died from recurrence in 3 months	1
Died from recurrence in 6 months	1
Died from recurrence in 10 months	1
Died from recurrence in 15 months	2
Died from recurrence in 18 months	1
Died from recurrence in 18 months	3
Died from recurrence in 2 years	5
Unable to trace	6
Alive and no sign of recurrence—	
One year	1
One and one half years	2
Three years	1
Four years	1
Four and one half years	2
Six years	4
Total	— 36

**POST OPERATIVE SEQUELÆ—**

Suppuration of abdominal incision	3
Cystitis	4
Peritonitis (recovery)	2
Rectal fistula	2
Vesical fistula	5
Phlebitis	1
Laceration of rectum (fistula)	1
Pleurisy	1
Rectovaginal fistula	1

These accidents largely occurred in the advanced cases in which the bladder or rectum were so closely involved as to render them almost unavoidable. Unfortunately, one frequently cannot determine before the operation has advanced beyond a point where it is impossible to abandon it, the degree of cancerous extension; consequently all operations for cancer of the cervix must

inevitably be attended with greater risks than in any other gynecological disease requiring hysterectomy.

However, in every series of cases thus far reported in which the radical operation has been employed, the surgical mishaps and post-operative sequelæ of greater or lesser extent have been relatively much larger than in the reports of simple hysterectomy cases.

**CANCER OF FUNDUS**

Merely for the sake of comparison, I include a series of thirteen cases of cancer of the fundus operated upon by a simple hysterectomy. As a rule, we have made no attempt to effect a wide dissection of the parametrium, and have not removed the iliac glands. The difference in results between cancer of the fundus and of the cervix is so startling as almost to persuade us that they are of an entirely different nature. For one, even when quite extensive, may be permanently cured by a simple hysterectomy, whereas the other may quickly recur, even when it but lightly involves the cervix, even after the most radical removal. We therefore expect good results from comparatively simple operative measures with the one, while the other gives us our worst surgical records.

**CANCER OF FUNDUS**

Total number of cases	13
Operative death (This patient died one week after operation from a general metastasis of chorio-epithelioma. Death occurred from widespread involvement of the lungs with the malignant process.)	1
Well over six years	5
Well over four years	1
Died after five years from recurrence	1
Died from continuance of disease in seven months	1
Died from recurrence in three years	1
Died from recurrence in one year	1
Died in two and one half years from mastoid abscess (Complete autopsy revealed no microscopic trace of cancer either in pelvis or in the abdominal lymph glands.)	1

As my cases stand they prove little or nothing. Certainly, they do not offer substantial argument for a radical operation as I have performed it, for, in my list of cases, only four are alive after the five-year period. One might favor the proposition that, of the six lost sight of, a proportion at least may have survived. This would be mere guesswork, and I accept the standard set by our

German confrères that the cases not accounted for cannot be utilized for statistical study. To count all lost cases against the operation is, however, hardly fair; for, it is impossible in this country to trace a more or less nomadic population, which has no police or other permanent registration.

There has been a primary mortality of a fraction over 8 per cent, which argues in favor of a less radical operation than that of Wertheim, whose mortality has been much higher, and yet Zweifel, from whose experience I have already quoted, had in his series of cases only eight and one half per cent mortality, but claims, nevertheless, a greater percentage of cures than Wertheim. I willingly grant that Wertheim has been more consistently radical than I, for I have varied the details of my technique, always with a hope of keeping the primary mortality within reasonable limits, and yet effecting a sufficiently wide extirpation of vagina and parametrium.

These cases at least prove conclusively one point, and that is, there is no middle-of-the-road policy. Either the operation must be extremely radical, with a considerable primary mortality and many distressing sequelæ with a larger number of ultimate cures among the survivors, or, on the other hand, it must be a much simpler technique, with a minimum primary mortality, few sequelæ, and a much smaller curative basis.

So far as my own experience is concerned, I may say as did von Rosthan that I am neither elated nor yet depressed in my failure to achieve better results. Certainly, the modern American surgeon has no reason to grant that his continental colleagues possess superior skill or a better technique than is in vogue here. Possibly a greater concentration of material in a smaller number of large university clinics may give a wider experience among a few skilled operators, and the earnest educational propaganda among the laity in Germany and Austria concerning the early signs of cancer may cause a larger number of patients to consult the surgeon in the earlier stage of the disease. As the matter now stands, the combined statistics favor the further trial and perfection of this principle

among those who are well prepared to carry it out in the most skillful manner.

From a review of the literature and from personal experience, I would offer the following summary concerning the radical operation:

1. The operation, in expert hands, notwithstanding its high primary mortality, has given the greatest percentage of permanent cures of any therapeutic procedure thus far suggested for cancer of the cervix.

2. While the above conclusion is true, the general adoption of the operation, in view of its dangers and difficulties, is not to be advised until the primary mortality can be reduced to a much lower percentage by a simplification or perfection of details.

3. The abandonment of the extensive glandular dissection is justified, because this detail adds to the hazards and does not sufficiently raise the percentage of permanent cures.

4. The cardinal advantage of the operation lies, first and above all in the excision of an extensive cuff of vagina and the widest possible removal of the parametrial tissue.

5. There is no middle-of-the-road policy in cancer of the cervix. The surgeon would better perform a simple vaginal hysterectomy or a high amputation of the cervix with extensive cauterization than to attempt the radical operation if he is not prepared effectively to execute its details.

6. The earnest endeavor by many specialists, with the improved ultimate cures in a few hands, offers the hope that a further simplification and perfection of details in this operation may yet make it more generally available.

#### CASES OF CANCER OF THE CERVIX OPERATED UPON BY THE MORE RADICAL ABDOMINAL HYSTERECTOMY IN THE GYNCOLOGICAL CLINIC OF THE UNIVERSITY OF PENNSYLVANIA

No 34. Case 1. 12-13-1899. 32 years; married 7 years. No pars. One miscarriage. Uterine colic with metrorrhagia. Examination. Epithelioma of cervix. Operation. Curettage and cauterization of cervix followed by panhysterectomy six days later. Convalescence. Abdominal incision opened and began to discharge and remained open for one month. Wound then closed with silk worm gut. Later passed small gauze pad by rectum. Following this, rapid convalescence. Result. Discharged 4-14-00. Died two years later from local recurrence.

No 125. Case 2 6-6-00. 35 years, married 17 years 1 para Irregular flow for last two years, excessive for last year. For last month or more had profuse hemorrhage with excessive malodorous discharge *Examination*. Cauliflower carcinoma, limited to the cervix on the right side but has extended into the vaginal fornix on the left Uterus freely movable *Operation*. Hysterectomy, combined abdominal operation following radical plan of Wertheim and Werder, cuff of vagina removed Glands not palpable *Convalescence*. Severe cystitis following operation. *Result*. Patient lived until 6-29-02, more than 2 years, dying of exhaustion Suffered intense pain Severe cystitis and suppression of urine

No 199 Case 3 10-29-00 63 years, married *Examination*. Carcinoma of uterus, outlet senile and greatly relaxed Cervix patulous, cauliflower growth Fundus of uterus normal in size and position *Operation*. Panhysterectomy *Convalescence*. Peritonitis *Result*. Died 10-31-00.

No 334 Case 4 45 years, married (history incomplete) *Examination*. Carcinoma of cervix extending into broad ligaments *Operation*. Hysterectomy Too far advanced for any hope of cure. *Convalescence*. 6-20-01 embolic pneumonia 6-27-01 breakdown in entire incision, stitch abscess and malodorous vaginal discharge *Result* 7-25-01 discharged Abdominal wound entirely healed Apparently in good general condition Not traced

No 384 Case 5 9-19-01 30 years, married 19 years 3 para Profuse bleeding with malodorous discharge *Examination*. Early carcinoma of cervix cauliflower type *Operation*. Radical hysterectomy. *Convalescence*. Stormy convalescence peritonitis Recovery *Result*. Patient alive over 6 years from time of operation

No 420 Case 6 10-27-1 36 years, married 15 years 2 para 1 miscarriage Malodorous discharge and menstrual periods have been profuse and too frequent for six months *Examination*. Cauliflower growth of the cervix *Operation*. Radical hysterectomy *Convalescence*. Following operation, pain in right side of abdomen, and right kidney greatly enlarged and easily palpable *Result* 12-14-01 discharged with a urinary fistula, gives her a burning sensation Unable to locate patient

No 632 Case 7 6-23-02 40 years, no history *Examination*. Extensive ulcerative growth of cervix Parametrial involvement *Operation*. Hysterectomy. Large lymph gland removed *Result*. Could not be traced.

No 671. Case 8 8-20-02. 54 years, widow, married 20 years No para No miscarriages General pain in lower abdomen Painful micturition. *Examination*. Adenocarcinoma of cervix. *Operation*. Panhysterectomy. *Result*. Death on second day after operation from general peritonitis (8-27-02)

No. 706. Case 9. 9-29-02. 44 years, married 19 years. 3 para Bleeding constantly for a month.

Felt weak and had fainting spells *Examination*. Carcinoma of cervix with hydrosalpinx Early case. *Operation*. Cauterization of cervix, and pan hysterectomy (10-11-02) *Convalescence*. Un eventful *Result*. Discharged 11-7-02 perfectly well. 6-24-04 hard mass in right iliac region Patient died 2 years after operation from general metastasis

No 731 Case 10. 10-29-02 37 years, married 5 years 1 para Flow became irregular 6 months ago Later profuse hemorrhage Malodorous *Examination*. Cauliflower cancer of cervix *Operation*. Hysterectomy. Glands palpable in left iliac region *Convalescence*. Stormy, suppuration of abdominal wound Establishment of ureterovaginal fistula, closed after patient returned home. *Result*. Patient died 12-23-03 extension of cancer into bladder

No 907 Case 11. 5-11-03 41 years, married 20 years 4 para Pelvic pain for three years very severe on walking Pains down left thigh and leg, diagnosed as rheumatism. Recently hemorrhage from uterus light red in color. *Examination*. Cervix large and soft with friable mass Tenderness and induration along left broad ligament *Operation*. Panhysterectomy *Convalescence*. Un eventful. *Result*. Discharged 6-11-03 1-2-04 all symptoms have disappeared and she feels much better No recurrence after six years

No 1060 Case 12 10-20-03 47 years, married 28 years 6 para No symptoms up to three months ago when patient began to have free bleeding *Examination*. Carcinoma of the cervix *Operation*. Hysterectomy Removal of considerable area of parametrium One pelvic lymph gland removed from the right iliac region *Result*. Patient died in 6 months from internal metastasis No local recurrence

No 1167 Case 13 2-29-04 26 years, married 9 years 1 para. Offensive discharge for last 7 years No significant change in periods *Examination*. Preliminary excision of cervical lip Microscopical examination shows carcinoma of cervix *Operation*. Panhysterectomy 10 days later No evidence of metastasis, glands not palpable *Result*. Patient died in three days of fulminating peritonitis

No 1247. Case 14. 6-26-06. 45 years; married 25 years 3 para For the last 10 months constant irregular bleeding Great weakness from loss of blood. *Examination*. Very early carcinoma of the cervix, which had not extended to surrounding area Uterus enlarged to size of 2 months' pregnancy Seat of fibroid *Operation*. Hysterectomy Extensive area of vaginal involvement but no extension into broad ligaments Pelvic glands not palpable *Convalescence*. Normal *Result*. Present date, patient alive and well since the operation.

No. 1379 Case 15 12-13-04 42 years, married 10 years. For 6 months periods have occurred every 2 weeks. *Examination*. Large cauliflower

mass springing from lip of cervix. No induration of parametrium *Operation* Preliminary cauterization, followed immediately by abdominal hysterectomy. Right angle clamps of Wertheim employed in this operation. *Convalescence* Infection of stump following operation. Vesicle fistula for a short time, healed before leaving hospital. *Result* Patient could not be located. Traced to two addresses and then lost sight of.

No 1700 Case 16 1-11-06 53 years, married 33 years 7 para Blood-tinged leucorrhoea of two months duration *Examination* Cervical carcinoma *Operation* Panhysterectomy *Convalescence* Tympanitis, intestinal paresis, vomiting with marked leucocytosis. Suppuration of wound *Result* Discharged 2-18-06, general condition excellent 4-17-10 (note) patient died from general metastasis 18 months later

No 1908 Case 17 8-31-06 47 years, married 2 para Excessive uterine bleeding *Examination* Carcinoma of cervix, completely destroying cervix *Operation* Hysterectomy Apparent metastasis to sigmoid flexure, possibly may be in inflammatory *Convalescence* Very stormy Severe peritonitis Intense cystitis Patient in hospital 40 days *Result* Her physician writes that she left his care and he has been unable to trace her since.

No 1976 Case 18 11-4-06 49 years, married 23 years 1 para Failing health for 2 years Vaginal discharge constantly for 5 months Lost 40 lbs in weight *Examination* Carcinoma of uterus Bleeding on examination from extensive crater of cervix *Operation* Panhysterectomy *Convalescence* Uneventful *Result* Discharged 12-27-06 perfectly well Patient died 15 months later from internal metastasis

No 2050 Case 19 2-1-07 49 years, married 30 years 3 para Constant pain in lower left quadrant of the abdomen extending to knee Leucorrhoea constant Scanty bleeding spells in last 4 years *Examination* Cervical carcinoma *Operation* Panhysterectomy Rectum punctured during operation Immediately repaired *Convalescence* Phlebitis *Result* Discharged 3-23-07. Physician reports patient alive and well

No 2267 Case 20 2-16-07 42 years, married 9 years No para One miscarriage Treated with tampons for three months Always bleeds after removal *Examination* Localized cauliflower carcinoma of cervix Extension into broad ligaments *Operation* Panhysterectomy *Convalescence* Rapid and uneventful *Result* Discharged 10-11-1907 Died 2 years later of local recurrence

No 2390 Case 21 1-27-08 37 years, married 18 years, 2 para Profuse bleeding 8 weeks ago Since then continuous discharge with trace of blood. *Examination* Part of cervix has sloughed away Uterus movable, broad ligaments free. *Operation* Extensive cervical cauterization, followed immediately by radical hysterectomy. Re-

sult. 5-1-12 patient alive and well, physician's report.

No 2755. Case 22. 12-4-08. 41 years, married 18 years 2 para Excessive leucorrhoea for last six months, varying from white serous to coffee-colored discharge *Examination* Early carcinoma of cervix No extension to vaginal wall or parametrium *Operation* Radical hysterectomy No palpable glands *Result* 5-25-12 no recurrence. Patient in excellent health

No 2758. Case 23 12-9-08 45 years, married 25 years 8 para Six months, watery discharge *Examination* Extensive cauliflower carcinoma, involving entire cervix *Operation* Hysterectomy *Convalescence* Infection of severe grade around vaginal wound *Result* Died 1 year later, local extension

No 2835 Case 24. 2-12-09 50 years, married 20 years No para Hemorrhage two months, yellowish malodorous leucorrhoea for three months *Examination* Cervix extensively ulcerated, bleeds freely on touch Large cauliflower mass filling vaginal fornix Two fibroid tumors of fundus uteri *Operation* Preliminary curettage and application of formaline followed immediately by hysterectomy. Extensive intestinal adhesions Cancer extended too far for radical operation *Convalescence* Intense suffering from cystitis and rectovaginal fistula Extensive suppuration of abdominal incision *Result* Died six months later

No 2952 Case 25 5-24-09 52 years, married 21 years 3 para Irregular hemorrhage 2 years, very profuse for last three months *Examination* Preliminary curettage, excision of cervical tissue for diagnosis, adenocarcinoma of cervix *Operation* Complete abdominal hysterectomy One enlarged pelvic lymph gland removed *Result* 5-1-12 in excellent health No evidence of recurrence

No 3074 Case 26 10-9-09 48 years, married 31 years 5 para Yellowish malodorous discharge, 3 months *Examination* Cancerous ulceration of cervix Uterus enlarged and slightly fixed in pelvis *Operation* Abdominal hysterectomy Extension of cancer along uterosacral ligaments Glands not palpable Adrenalin and formalin packing around vaginal wound. *Result* Patient died 8-28-10, internal metastasis Severe pain Vesical fistula developed some time before death

No 3081 Case 27 10-17-09 43 years, married 21 years 2 para Losing weight for 2 years Almost continuous bleeding for four months *Examination* Cauliflower mass filling vagina, and extensively involving cervix *Operation* Abdominal hysterectomy. Wide extirpation of uterus. Adrenalin-formalin packing in vaginal vault. Glands not palpable *Result*. Could not be traced

No 3133 Case 28 12-5-09 48 years, married 26 years 2 para Profuse discharge with bloody tinge. *Examination* Carcinoma of cervix. *Operation* Panhysterectomy *Convales-*

cence. Bladder irritability. Malodorous discharge from vesicovaginal fistula. *Result.* 1-3-10 discharged. Fistula persisted for 6 months, later interstitial fistula developed through abdominal scar. Died from general peritoneal metastasis 18 months after operation.

No. 3191. Case 29 2-6-10 50 years, widow 2 para No miscarriages. Malodorous discharge of two or three months' duration. Frequency of urination. Loss of weight and strength. *Examination* Carcinoma of cervix. *Operation* Panhysterectomy. *Convalescence* Pleurisy. *Result.* Discharged 3-10-10. No bladder irritation, but complained of severe backache. Died one year later of internal metastasis.

No. 3302 Case 30 8-3-10 24 years, married 8 years 4 para Whitish thick discharge for one year. Hemorrhage daily for 7 weeks. *Examination* Carcinoma of cervix (interstitial). *Operation* Complete hysterectomy. *Convalescence* Uneventful. *Result* 4-20-12 physician reports patient alive. "She is fat feels well and does all of her own housework." No evidence of recurrence.

No. 3566 Case 31 1-27-10 36 years, married 18 years 7 para For six months, hemorrhagic discharge with yellowish leucorrhoea. *Examination* Extensive cancerous involvement of cervix. Parametrial involvement. *Operation* Hysterectomy, extension to bladder. Several iliac glands removed. *Convalescence* Extensive lymphatic metastasis. *Result* 5-10-12 Extensive recurrence, intense pain, requires morphine in large doses.

No. 3566 Case 32 1-17-11 40 years, 1 para Yellowish discharge and profuse irregular flow, 6 months. *Examination* Cauliflower carcinoma involving both cervical lips parametrium slightly involved. *Operation* Preliminary cauterization. *Hysterectomy* *Result* No symptoms of recurrence.

No. 3603 Case 33 1-23-11 64 years, married 15 years 4 para Severe pain in lower abdomen. Continuous oozing of blood. Pain in rectal area. Marked loss in weight and strength. *Examination* Carcinoma of cervix. Extensive involvement of cervix and broad ligaments. *Operation* Panhysterectomy. *Convalescence* Uneventful. Cystoscopic examination showed vesico-ureterovaginal fistula. *Result* Discharged 3-6-11. Vesico-uretero vaginal fistula persisted. Repaired one year later, 18 months later extensive recurrence, death from large vesical hemorrhage.

No. 3611 Case 34 1-30-11 51 years, married 27 years, 4 para Since menopause 8 years ago, vaginal discharge, profuse hemorrhage 8 weeks ago. *Examination* Early carcinoma of cervix. No palpable parametrial involvement. *Operation* Preliminary cauterization. *Hysterectomy* Gland not palpable. *Result* 4-26-12 Well, no evidence of local recurrence.

No. 3753 Case 35 5-22-11 40 years, married 33 years 2 para For 6 months periods have been much more profuse and more prolonged

*Examination.* Ulcerative crater, involving both lips of cervix, not extensive. No palpable extension to parametrium. *Operation.* Preliminary cauterization. *Hysterectomy.* Extension to lymph glands and both iliac fossae. One or two glands removed. Showed metastasis. *Result.* Died 11-11-11. Cancer recurred, invaded bladder and rectum. Intense pain in iliac region.

No. 3818. Case 36 8-24-11 40 years; married 6 years. 3 para. Symptoms for 8 weeks. *Examination* Early carcinoma of cervix, not extending to vagina or into broad ligaments. *Operation* Complete abdominal hysterectomy. *Convalescence* Uneventful. *Result.* Well, with no sign of recurrence, 4-27-12.

#### CARCINOMA OF FUNDUS, SIMPLE ABDOMINAL HYSTERECTOMY

No. 3270 Case 1 4-13-01 42 years; married 20 years 4 para Periods every two weeks and very profuse. Time of bleeding increased from 7 to 10 days, passed many clots. *Examination.* Myoma uteri with carcinoma of cervix. *Operation.* Supravaginal myomectomy and bilateral salpingectomy, left oophorectomy and appendectomy. *Convalescence* Uneventful. *Result* Discharged 5-4-10 with a low-grade phlebitis of the left leg. Patient well over six years after operation.

No. 327 Case 2 3-4-02 40 years, married 22 years 3 para 9 months ago began to have severe uterine bleeding, which continued up to the present time. *Examination* Uterus enlarged. On curettage large amount of brain like tissue removed. Carcinoma of fundus. *Operation* Simple hysterectomy. *Convalescence* Satisfactory. *Result* Present date patient alive and in good health.

No. 024 Case 3 5-26-03 50 years, single. Symptoms not given. *Examination* Carcinoma of fundus. *Operation* Abdominal hysterectomy. *Convalescence* Uninterrupted. *Result* Patient living and well.

No. 1072 Case 4 11-0-03 55 years, married 31 years 1 para No abnormal menstrual symptoms up to 35 years. Large ovarian cyst indication for operation. *Examination* Cancer of the fundus was found on pathological examination. *Operation* Simple hysterectomy. Removal of ovarian cyst. *Convalescence* Normal. *Result* Present date, patient well, no recurrence.

No. 1131 Case 5 1-25-04 56 years (history incomplete). Bilateral pain in the lumbar region. Frequency of urination. *Examination* Carcinoma of fundus. *Operation* Complete hysterectomy. *Convalescence* Abdominal distention, nausea, vomiting. *Result* Discharged 2-22-03 in good condition. Died three years later of local recurrence.

No. 1524 Case 6 5-17-05 43 years, married 23 years. No para. Last two months has had profuse hemorrhage. Has lost greatly in weight. Severe degree of anemia. *Examination* Uterus enlarged; cervix normal. Curettage shows friable material, undoubtedly cancer. Interstitial cancer

*Operation.* Hysterectomy. *Convalescence.* Normal. *Result.* 6-1-1912, patient alive and well. No. 1609 Case 7. 10-3-05 55 years, married. Slight leucorrhœa and dribbling of blood for a year. *Examination.* Carcinoma of fundus extending to sigmoid flexure. *Operation.* Panhysterectomy. *Result.* Well up to 10-3-11, when she noticed hæmorrhage from the bowels. Died from general carcinomatous metastasis. Had passed five-year period when recurrence occurred.

No. 1954 Case 8. 10-8-06 52 years, married 12 years. 3 para. Irregular bleeding for nine months. Vaginal discharge for one year. Prolonged periods. *Examination.* Cervix intact, uterus enlarged, freely movable. Curettage shows carcinoma of fundus. *Operation.* Panhysterectomy. No involvement of lymph glands. *Result.* Recovery before she left ward. Patient well and doing heavy work 10-1-11, when there was a recurrence. Died from suppression of urine. Had just passed five-year limit when recurrence occurred.

No. 1433 Case 9. 1-11-05. 31 years, married 14 years. 7 para. Vaginal bleeding for three weeks, with chills. *Examination.* Chorio-epithelioma of uterus. Relaxed vaginal outlet. Cervix soft, uterus enlarged. *Operation.* Panhysterectomy. *Convalescence.* Dyspnoea, pain in chest with cough. Physical signs in chest negative. Rusty sputum, cardiac murmur over apex. *Result.* Died within week after operation. Post-mortem examination showed general metastasis.

No. 2189 Case 10. 7-3-07 40 years, single.

*Examination.* Myoma uteri with cancer of fundus. *Operation.* Partial hysterectomy. Impossible to remove cancerous metastasis. *Result.* Died 7 months later, continuation of disease.

No. 2083 Case 11. 6-15-00 55 years, married 14 years. 3 para. More or less constant bleeding for a year. *Examination.* Extensive cancer of fundus. Metastasis to broad ligaments. *Operation.* Abdominal hysterectomy. Wide excision of parametrium but cancerous tissue appeared to have passed beyond border lines of operation. *Result.* Patient died 10-26-10. General metastasis. Extensive local recurrence. Severe pain. Cystitis. Suppression of urine.

No. 3121 Case 12. 11-23-09 40 years, married 20 years. 1 para. Irregular hæmorrhage for one year. Cramp-like pains referable to gall-stones. *Examination.* Carcinoma of fundus with slight cancerous involvement of vagina. *Operation.* Hysterectomy. Only slight area of cancer in fundus. *Result.* 4-25-12 Well, examination shows no evidence of recurrence.

No. 3144. Case 13. 12-16-09 56 years, single. Yellow leucorrhœa with profuse uterine hæmorrhage. Marked loss in weight in last year. Constant backache, epigastric pain. *Examination.* Carcinoma of fundus. *Operation.* Panhysterectomy; dilatation and curettage showed large piece of friable material. *Convalescence.* Uneventful. *Result.* Discharged 1-13-10. 5-1-12 patient died of acute cerebrospinal meningitis. Autopsy revealed no microscopic trace of cancer.

## THE RADICAL OPERATION FOR CANCER OF THE UTERUS<sup>1</sup>

By THOMAS S. CULLEN, M. D., BALTIMORE

THE early recognition in recent years of cancer of the body of the uterus, and, as a consequence, the complete removal of the uterus, has led to such excellent temporary as well as permanent results that a consideration of this variety of cancer of the uterus is at this time entirely unnecessary. Some operators claim that nearly all of these patients are permanently cured of their cancer, and a most conservative estimate would be that fully two thirds of all cases of cancer of the body of the uterus operated upon never show any further manifestation of the disease. This fact is often lost sight of in the gloomy reports frequently published on the final results in cancer of the uterus. The diagnosis in the majority of the

cases of cancer of the body of the uterus has been made from scrapings, and from them the diagnosis is rendered certain in the incipient stage of the disease. In no other branch of surgery has the value of the microscope as an aid to the surgeon been more signally demonstrated. In the present address, therefore, I shall limit myself to a consideration of cancer affecting the cervix.

### CANCER OF THE CERVIX

Before considering the immediate and end results in the radical operation for cancer of the cervix, permit me to outline the salient points in our operative treatment of these cases.

*Operability.* It is very difficult to ascertain the percentage of cases that are suitable

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America, New York City, November 14, 1912.



for operation. Many patients never see a physician until the disease is too far advanced for any radical operation, and often it happens that the surgeon is not even called upon to see the patient. Again, as pointed out very clearly by Taylor, numerous far advanced cases of cancer of the cervix are seen in the dispensaries, and only a minority of these reach the operating room.

When the cervix is freely movable, we consider the case operable; and although the growth may have extended to the vaginal wall, and even if the broad ligament on one side shows diminished mobility, provided the patient is in a fair physical condition, the abdominal operation is considered justifiable.

Before declining to operate, it is, as a rule, advisable to examine the patient under an anæsthetic, as one is occasionally able to detect that the lateral thickening is due, not to an extension of the cancer, but to a coincident inflammation of the tube and ovary. This we have noted on several occasions, and Taylor has recently drawn attention to this point.

#### TECHNIQUE OF THE OPERATION

I have never performed a vaginal hysterectomy for cancer of the cervix, but would not hesitate to do so were I dealing with a very stout patient suffering from a carcinoma of the cervix, associated with marked prolapsus.

*Preparatory treatment of the cervix.* In some of the cases, we have cauterized the cervix thoroughly and then abstained from all local treatment for a week, thus giving the raw area a chance to contract down. In some instances, this procedure has been followed by a marked "loosening up" of the cervix, and the uterus, which, prior to the cauterization had apparently been somewhat fixed, in the course of a few days had become freely movable. On the other hand, I have noted that some patients take a second anæsthetic within seven or eight days very badly, and so much have I been impressed with this fact that for several years I have, whenever possible, done the cauterization only just prior to opening the abdomen.

My colleagues at the Johns Hopkins Hospital, at the present time, after cauterizing the cervix and washing out the vagina, flush

it out with an iodine and alcohol solution (iodine 3.5 per cent). When this is removed, the vagina is filled with alcohol. After this in turn has been removed, the vagina is thoroughly dried and is then filled with gauze. This method has proved to be most satisfactory.

#### ABDOMINAL HYSTERECTOMY

The operation is patterned after that described by Wertheim. Good exposure of the field of operation is absolutely necessary to secure a thorough removal of the diseased structures. When the patient is very stout, a transverse wedge of skin and fat down to the fascia may be removed, and the abdomen then entered through a longitudinal incision. This procedure greatly reduces the depth from the surface to the floor of the pelvis, and materially cuts down the time consumed in the operation.

In quite a number of the cases, we have employed an electrically heated table throughout the operation, and it has seemed to me that these patients left the table in a much better condition than the average patient after hysterectomy for cancer.

Proper illumination is of great importance in this operation, and we have found the Kronig light of much value in flooding the field of operation with a steady and most satisfactory flow of artificial sunshine. This light is a great adjunct to any operating room.

As many of the patients are weakened by the long standing hæmorrhage and discharge, I try to save the strength as much as possible by not placing the woman in the Trendelenburg posture until the pelvis has been carefully walled off and the operator is ready to expose the ureters.

As a rule, I have found no difficulty in locating and isolating the ureters except in very stout persons. Here the peritoneum appears to be excessively thin, while the underlying fat is correspondingly thick, and the small blood-vessels in the fat tear on the slightest traction. When the patient is thin, I rarely encounter much trouble until the vaginal veins to the outer side of and below the ureter are reached. These are usually readily controlled with the long Wertheim forceps, but

now and then give rise to alarming bleeding. Occasionally, prior to cutting across the vagina, I apply the right-angle Wertheim clamps, but usually, after doubly walling off the uterus from the pelvic wall, and having had an assistant wipe out the vagina until the pledgets come away free from stain, I cut across the vagina, picking up the vaginal margins with Ochsner clamps.

After all oozing from the vaginal margins has been controlled the bladder peritoneum is tacked to the edge of the mucosa of the anterior vaginal wall. Thus, as the bladder distends, it is the peritoneally covered area that ascends, and no raw surface is left to ride over any drain that may be left.

In some of the cases I have removed the pelvic glands, in others I have not disturbed them. Many of my patients were much exhausted by the operation, and I felt that any further time expended in manipulation in the abdomen would seriously jeopardize the patient's life. In 1900, in my book on cancer of the uterus, I drew attention to the fact that an enlarged gland did not necessarily indicate cancer, inasmuch as the enlargement might be due to septic absorption from the cervix. Peterson, in his series, removed the glands in 29 cases, and in 5 of these found metastases. Of the 5 patients, one died after operation, 3 had a recurrence, and one was well after 3 years. Whether the glands are to be removed or not must depend on the condition of the patient, and must be left to the judgment of the individual operator.

*Closure of the pelvis.* After the bladder has been attached to the anterior vaginal wall and the posterior vaginal wall to the rectum, the broad ligaments are closed. If all oozing has been completely checked, a small cigarette drain is laid in the pelvis and brought out through the vaginal opening, which is now not over 1.5 cm. in diameter. Where there is a little oozing in one or both broad ligaments, I have occasionally placed a cigarette drain in the lower angle of each broad ligament, bringing the ends out into the vagina.

*Duration of the operation.* When the carcinoma of the cervix is in an early stage, the patient is not likely to have lost much blood, and, as little sloughing has occurred, there

has been a minimal amount of septic absorption. In such cases the operation is a relatively easy one. In the far advanced cases the patient is frequently cachectic as a result of the anemia and the absorption of septic products. In these cases the growth often extends alarmingly close to the ureter, and as a result the dissection is slow. This prolongation of the operation in a patient already greatly weakened by the disease often leads to an alarming collapse before the operation is completed. Such a patient will stand the operation relatively well for from one to one and a half hours, and then suddenly collapse. A Wertheim operation, at best, is one of the most difficult of all the abdominal procedures, consequently the operator needs to be in the best possible physical condition. He should make it his first operation of the day, and preferably perform it early in the morning, when he is fresh. Stimulation of the patient should be undertaken, even before there are the slightest signs of collapse.

When the cervix has been torn across during removal of the uterus, thus materially increasing the danger of peritonitis, I occasionally place an abdominal drain in the lower angle of the incision, in addition to the one emerging from the vagina. In these cases we place the patient in the Fowler position immediately after the operation, if the pulse will permit.

#### RESULTS IN THE RADICAL ABDOMINAL OPERATION FOR CANCER OF THE CERVIX

When the Committee of the American Gynecological Society met in Baltimore to arrange the program for its annual meeting, which was held in May of this year it was unanimously agreed that the time had arrived when we should take stock of the results of abdominal hysterectomies for cancer of the cervix in America. The results of some of these labors are to be found in SURGERY, GYNECOLOGY AND OBSTETRICS for August, 1912. That number of the journal includes interesting articles by Peterson, Taylor, and Taussig.<sup>1</sup> At the meeting, Graves

<sup>1</sup> Dr John G. Clark of Philadelphia, Dr J. Sampson of Albany, and several others also briefly reported their results in the radical operation. Dr Clark's paper appears on p. 255 of this issue, Dr Sampson's on p. 203.

reported the results of his work in Boston and Peterson gave his statistics from Ann Arbor, Taylor sent out circular letters to about 175 operators in New York, Brooklyn, and Philadelphia. In his paper he says, "The replies which I received did not give me any information along the line that I wished, and I have not been able to deduce from them anything of value as to the ultimate result of cancer operations in these two states." He learned, however, two things: first, the entire absence of reliable statistics among the operators, second, the universal feeling among the surgeons that the patients were not seen early enough to be permanently relieved.

Taylor then reports his own results. His immediate mortality was only 3 in 28 cases. Unfortunately many of his patients were lost track of, so that he could not determine the relative percentage of permanent recovery.

Tausig communicated with surgeons west of the Mississippi River. In all, he collected records of 60 patients, only 14 of these operations dated beyond the five-year limit. He says, "By a strange coincidence, there was not a single operative mortality among these first 14 patients. Apparently, each operator was particularly careful in the selection of his first cases." Of the 14 patients, one could not be traced and one had died of an intercurrent disease. Of the remaining 12 patients, 5, or 41.6 per cent of these, were still free from recurrence. This is an exceptionally good showing, even though the numbers be small.

Neel<sup>1</sup> after much labor, was able to trace the records of the cancer cases operated on by the radical method at the Johns Hopkins Hospital. These operations were performed by Dr. Kelly and his associates, and by the residents during the various years. Neel reported, in all, seventy cases in which over five years had elapsed since the radical operation had been performed. There was an immediate mortality of 20, or 28.6 per cent. Of the 50 patients leaving the hospital, nine had been lost track of, and one had died two years later of pneumonia, 14, or 20 per cent of the total number of patients, are to-day free from recurrence, and the remainder had died with

unmistakable evidence of return of the growth. Neel draws attention to the fact that, if we deduct the 20 that died immediately and discard the patient dying of an intercurrent affection, and also subtract the nine cases that were lost track of, he still has 40 patients that survived the operation, and concerning whom he has definite data. Fourteen, or 35 per cent of the 40 patients, are still alive.

At the request of the Committee of the American Gynecological Society, I was asked to find out to what extent the radical abdominal operation was employed for carcinoma of the cervix in the Southern states. Letters were sent out to most of the surgeons in the South, and I take this opportunity of thanking the many who took the time and trouble to reply. The majority had never done a Wertheim operation, a few had performed it two or three times, and had lost sight of the patient. Only in a few instances were the statistics of any value to us, either because the operation was of such recent date or because the patient could not be traced.

Under date of April 6, 1912, Dr. George Tully Vaughan of Washington writes: "In reply to your letter asking for data of Wertheim or other abdominal hysterectomies for cancer of the cervix, I should say that I have not had a large experience in gynecological work. About five complete abdominal operations for cancer are all I can muster—one death and the others still living, so far as I know. One, at least, was heard from recently, three years after the operation."

Dr. H. H. Grant of Louisville, Kentucky, replying under date of April 9, 1912, says: "I have done but seven panhysterectomies for carcinoma, and but two of these included exploration for intra-abdominal glands, none claiming to be Wertheim. There was no immediate mortality. Two of these patients were subjected to amputation of the cervix, because of doubt, and in one, Mrs. L., aged 37 years, reoperation was done after three months for a threatening recurrence in 1900. She died of recurrence ten months after the second operation. The other, aged 41, was reoperated on in three weeks. She died in five months, of recurrence. The other five

<sup>1</sup> Dr. Neel's paper appears in this issue on p. 392.

cases are still living. Mrs. W., aged 54, operated on November, 1909, well; Mrs. B., aged 47, operated on in February, 1910, well; Mrs. M., aged 51, operated on in April, 1911, well; Mrs. C., aged 42, operated on in March, 1910, suspicious; Mrs. M., aged 48, operated on in December, 1911, well."

Dr. J. Mason Hundley of the University of Maryland has had quite a number of permanent cures, and is a most enthusiastic advocate of the radical operation. Under date of November 1, 1912, he writes: "I find we have records of 21 radical operations for cancer of the cervix done by me since 1905. Of that number, 2 died as a result of the operation and one died after reaching home. Four are living and apparently well: one operated upon about six years ago, three between seven and eight years; and one is now dying, operated upon three years ago. Three are living after two years. The remainder have been lost track of."

At the meeting of the American Gynecological Society, I reported my results in 49 cases in which a complete abdominal hysterectomy was attempted. As noted from the accompanying table, brought up to June 1, 1912, there were 11 immediate deaths, a mortality of 23 per cent, 3 patients were lost track of, and are accordingly included among the dead; 21 died at periods varying from a few months to six years. Fourteen were living and apparently well at the time of the meeting.

Some of the deaths were due to uncontrollable venous oozing, others to shock due to hæmorrhage or to the greatly weakened condition of the patient, others to renal complications, and, in a few instances, to a localized purulent peritonitis. In the tabulation of remote deaths, it will be noted that in some it was clearly evident at the time of operation that the entire growth had not been removed. The death in nearly all of these cases was due to a continued progress of the disease.

*Five-year limit.* Twenty-six of my cases were operated on over five years ago. Of this number, seven died while the patient was still in the hospital. One of the patients was lost track of. Eleven died at periods varying from a few months to six years, and seven, or 26.9 per cent, are well to-day.

1 is well	6½ years after operation.
1 is well	8 years after operation.
1 is well	8 years and 4 months after operation.
1 is well	8 years and 6 months after operation.
1 is well	9 years and 8 months after operation.
1 is well	9 years and 10 months after operation.
1 is well	13 years after operation.

In three of these cases, the ureters were catheterized prior to opening the abdomen.

The cancer in four of these successful cases was apparently confined to the cervix, the uterus being freely movable. In one case, the growth had extended into the right broad ligament and encroached alarmingly on the ureter.

In one case, the carcinoma had made such extensive inroads on the anterior wall of the cervix that the bladder had become densely adherent to it, and was opened during the dissection.

In the remaining case, the cervix was so extensively involved that, during the operation, the body was almost completely torn away from the cervix, and on examination of the specimen after removal, the carcinoma was found to have extended almost to the cut surface. In this case a most guarded prognosis was given. It is now over eight years and six months since this uterus was removed. I need hardly add that in every case a histological examination was made.

#### RESULTS OF ABDOMINAL OPERATIONS FOR CANCER OF THE CERVIX<sup>1</sup>

##### *Immediate death, 11 cases —*

Richardson, April, 1902  
Tate, July, 1902 (H).  
Kyle, October, 1902 (H).  
Compton, April, 1903  
Rogers, March, 1905  
Hayward, February, 1906  
Vogelsang, November, 1906 (H).  
Havistuck, August, 1909  
King, December, 1909 (H)  
Pfall, January, 1910.  
Harris, November, 1910 (H).

##### *Not located, 3 cases —*

Collins, January, 1905  
Welch, January, 1908 (H)  
Onens, February, 1908 (H).

##### *Patients living, 14 cases —*

Ryan, June, 1911; 11 months (H).  
Carroll, May, 1911, 12 months (H).  
Griffith, October, 1910; 18 months  
Lucas, November, 1909; 2 years, 5 months (H)  
Heilman, December, 1908, 3 years, 5 months (H).  
Sangwin, May, 1909; 3 years, 6 months

<sup>1</sup> Those marked with (H) I performed at the Johns Hopkins Hospital, the others were done at the other hospitals with which I am connected.

Conklin, June, 1908, 3 years, 8 months (II).

Humphreys, December, 1905

Herzen, April, 1904; 8 years

Verkes, January, 1904

Brown, August, 1903, 8 years, 6 months

Wotten, August, 1902, 9 years, 8 months

Mrs M., patient of Dr Geo H Carveth, Toronto,

December, 1902, 9 years, 10 months

Ketter, June, 1899, 13 years

*Remote death, 21 cases —*

White, April, 1903, partially removed

Tolley, April, 1903, partially removed

Rowen, November, 1911, 2 months, uremia, blindness

Olfers, April, 1908, recurrence, 3 months (II)

Jones, 1910, died, 6 months (II)

Boezeman, December, 1910, incomplete removal. Died,

6 months

Smiley, June, 1910, died, 6 months

Finkle, April, 1903, died, 8 months

Porter, January, 1905, not entirely removed, died, 11

months

Karr, July, 1906, died, 14 months (II)

Franklin, February, 1908, died, 16 months (II)

Willis, October, 1905, died, 18 months (II)

Mack, February, 1908, died, 19 months (II)

Raymond, January, 1908, died, 21 months (II)

Ierguson, September, 1906, died, 21 months (II)

Trepo, January, 1900, lived 2 years

Baldwin, May, 1907, lived 3 years

Arldinger, July, 1908, lived 2 years, 10 months (II)

Stehle, May, 1904, lived 4 years

Riggins, January, 1905, lived 5 years

Mengel, May, 1904, lived nearly 6 years

*Operated on over 5 years ago, 26 cases —*

Immediate death, 7 cases

Not located, 1 case

Remote deaths at periods varying from a few months

to nearly 6 years, 11 cases

*Living —*

7 cases or 26 per cent

### PROGNOSIS

Even after removal of the uterus, it is very difficult to give a satisfactory forecast as to the ultimate result. Sometimes a case that seems most favorable shows an early recurrence, while a border-line case that looks most unfavorable may remain free of the disease. When the growth of the cervix is of a glandular type, however, we may look for a speedy return.

An early local return, while most disconcerting, need not necessarily prove fatal. Nearly two years ago, a very competent surgeon in a Southern state did a radical operation, and within a few months a carcinomatous nodule was detected in the vault. In this case, on account of the proximity of the carcinoma to the ureter, I opened the abdomen and isolated the ureters and removed a long cuff of the vagina. This patient, up to the

present time, 16 months later, has had no further manifestation of the disease.

*Temporary Relief.* Some surgeons are of the opinion that, if the entire growth has not been removed, the patients suffer much more than if no radical operation has been performed. In my experience, the patient in the late stages is no more prone to pressure symptoms than is the woman who has not been operated upon. On the other hand, frequently the growth spreads in such a manner that the vaginal mucosa is not again involved, and the patient is accordingly spared the frequent hemorrhages and the foul-smelling discharge. I am frank to admit that in some cases I would have refrained from operating had I been aware of the widespread extension of the disease, but sometimes, when the growth is not very dense, the extent is only ascertainable when the operator has partially completed his dissection, and complete removal of the uterus cannot then be avoided.

### DEDUCTIONS

It is difficult to lay down a hard and fast rule as to what cases should and what cases should not be operated upon. All familiar with the course of this dread disease know that in time the hemorrhages become very severe, and that later on, in the intervals between hemorrhages, the patient has a most foul and loathsome discharge, and that in some cases rectovaginal or vesicovaginal fistulae or both may develop. They also know that the patient becomes a burden to herself and a source of the greatest anxiety to her family, who are powerless to do anything, and finally, that most painful pressure symptoms may develop. With such an outlook, I feel sure that there is not a man in this audience who, if brought face to face with such a problem in his own family, would not gladly take the chance of an operation, if there were only one or two chances in a hundred, as a matter of fact the chances are infinitely better.

Over a decade ago, when speaking before the Academy of Medicine in this city on the early diagnosis of cancer of the uterus, one of the most distinguished gynecologists of New York, in the discussion, said, if I remember correctly, that he had operated on over 120

cases of carcinoma of the uterus, and that at the time of the meeting not one of them was living.

The splendid results obtained by Wertheim and others in Europe leave no doubt that great strides have been made in the cure of cancer of the uterus, and even from the limited observations in America, it is clear that considerable progress has been made, and there is no reason why we should not materially increase our percentage of permanent cures. The Germans certainly have one advantage over the American surgeons. Many of their patients have had large numbers of children and, owing to their manner of work, have not accumulated the large amount of adipose tissue that is so prevalent with us. Consequently the continental operator can at once secure a much better exposure, and is not troubled with the abundance of adipose tissue around the ureter and in the broad ligament.

The oftener the surgeon performs this operation, the more expert he becomes, the length of the operation is shortened, and consequently the death rate is lowered. The German surgeons apparently see many more of these cases than surgeons in this country. During my last trip to Germany, I was making rounds with Professor Zweifel, in Leipzig, and he told me that in one month he had performed fifteen Wertheim operations for cancer of the cervix. It is, therefore, only natural that the German surgeon should have a lower operative mortality. Again, the continental surgeon has materially profited by the widespread publicity which the cancer problem has received, both in the profession and among the laity.

From time to time attempts have been made in America to start an education of the women of this country to the necessity of reporting any suspicious symptoms at once to their physicians, but, apart from some spasmodic efforts, nothing has really been accomplished. It would be most fitting if this splendid society should here and now start a cancer campaign that would extend from coast to coast. It can and should be undertaken at once. Publications that have done much to enlighten the laity on medical matters could

be of invaluable service in the dissemination of this knowledge.

The laity now have a clear idea of the subject of appendicitis, and whereas a decade ago it was often necessary for the family physician, after making the diagnosis, to spend hours in urging the necessity for immediate operation, at the present day, after he has given his verdict, the first question asked by the family is, to what hospital the patient should be sent.

The splendid crusade against tuberculosis is another example of the immense amount that has been accomplished by the education of the rank and file of the community.

Two or three well-illustrated articles, explaining in simple words just what cancer is, how it spreads, and what may be accomplished by early operative interference, will be all that is necessary to put women on their guard. Many of them have an innate fear that they will some time develop cancer of the uterus, and are fully aware of the distressing train of symptoms in the advanced stages of this dread disease. What we want to do is to impress upon them the fact that any abnormal bleeding, no matter how slight, should be immediately investigated by their physician to ascertain if cancer be present. If no malignancy be found, they are relieved of their unnecessary anxiety. If cancer be present, it can be combated in the early stages. The fact that early cancer may be successfully eradicated by operation, and that it is in the beginning a strictly local process instead of a "general blood disease," as it is so often referred to by the laity, should be most forcibly impressed upon the community.

The sooner this subject is launched the sooner will our percentage of permanent cures increase. I feel sure that after women in general are thoroughly familiar with the necessity of an examination just as soon as they present any symptoms, the surgeon will be able to save, at a conservative estimate, from 20 to 25 per cent of these cases.

Among the most important surgical papers that emanate from the larger clinics are those which deal with the after results in various operative procedures, and it is well worth the while of every surgeon to "take stock" at

regular intervals. Having a vivid recollection of the numerous immediate deaths I had encountered following the Wertheim operation, I hesitated long before I could make up my mind to attempt to locate the patients that had left the hospital. But when, finally, the work was commenced, and it was found that some patients had enjoyed comparative comfort for one, two or three, or even six years, I felt that the operation had been worth while. And when seven letters came back saying that the patients were well at periods varying from six to thirteen years, and expressing the most profound thanks for what had been done for them, I could not help feeling that the radical abdominal operation is the one destined to yield the best results.

This is an operation, however, that cannot be lightly undertaken, as it requires the very best efforts of the surgeon. My friend, Reuben Peterson, has expressed my sentiments so well that in conclusion I will quote what he has recently said on the subject.

"My belief in this operation has only become stronger. However, the experience afforded by eleven additional cases has not made me any more confident that the next patient I operate upon will either survive the primary operation or will ultimately be cured. On the contrary, in contrast with other abdominal operations, the more I perform this operation the more I respect and, possibly, dread it. Yet I adhere to it for the simple reason that, in my hands, all other operations for cancer of the uterus have been disappointing in their uniformly bad ultimate result, while with the radical abdominal technique I have been able to save a fairly good percentage of my patients, and that, after all is said, is what the surgeon is after. If he be not content to set at naught his surgical reputation as far as primary results are concerned for the sake of ultimately curing more patients, he would best not meddle with this operation, which, in apparently favorable cases, is only too apt to turn out to be grave."

## THE CAUTERY IN THE RADICAL TREATMENT OF CANCER OF THE CERVIX<sup>1</sup>

By X. O. WERDER, M. D., PITTSBURGH

THE cautery, at least at the present time, is not generally associated with the radical operation of this condition, but is considered a very useful and important aid in the palliative treatment of cases of cancer which have reached the inoperable stage, and consequently, with its use we do not expect a cure, but merely a relief of symptoms and a temporary check to the advance of the neoplasm. But it is within the recollection of many of us here present when the cautery, either in the form of the galvanic loop or the cautery knife and dome, gave results which excelled all other methods of treatment then in vogue. I need only refer to some of our own countrymen, such as Baker, of Boston, and Reamy, of Cincinnati, who, by a high amputation of the cervix by means of the

hot platinum loop, succeeded in permanently curing a large percentage of early carcinomata of the cervix. The most remarkable record, however, was unquestionably obtained by Byrne, of Brooklyn, partly because of the great number of cases treated by him, as well as the wonderful results obtained by a minor operation without a single operative death. In the 367 cases treated by him during twenty years, he had nineteen per cent living five years after operation—this in spite of the fact, as I have been reliably informed by some of his colleagues and pupils, that he made no selection of his cases, but operated on practically all coming under his care, no matter how extensive and hopeless the neoplasm was found to be. This successful experience in the use of the cautery was

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America, New York City, November 14, 1913.

not confined to these few men, but many others in Europe had similar results, especially Carl Braun, of Vienna. Even Schroeder, who was not an advocate of the cautery, but used it only in the advanced cases, was surprised at several unexpected cures, in apparently hopeless cases, by this means.

It may well be asked why such favorable results in advanced cases of carcinoma of the cervix are so extremely rare now, though the cautery is still in common use in inoperable cases. Do we use the same technique and methods so successful in the hands of Baker, Byrne, and others? Baker<sup>1</sup> states that it is of the greatest importance not only to apply the cautery very thoroughly and over a considerable length of time, but also to keep these cases under observation, to excise any suspicious tissues promptly and again cauterize very thoroughly. After two or three such applications he has succeeded in getting some of his best results.

Byrne<sup>2</sup> also strongly emphasizes the importance of very thorough cauterization, no matter by what means the growth may have been removed. He also wishes to impress the patient with a sense of the vital necessity of frequent examinations after any operation. I am afraid there are few of us who carry out the instructions of these old masters, particularly with reference to repeated cauterizations. We are all inclined to be too pessimistic in dealing with these advanced cases. We lack interest in these inoperable cases, because we consider them doomed from the outset, and think our duty fully performed by giving them the benefit of one thorough cauterization. We are then only too ready to dismiss them from our observation and leave them to their sad fate, without any encouragement to return for further treatment. With greater patience and perseverance and more confidence in the cautery we might be more successful in prolonging these unfortunates' lives, and, possibly, even occasionally obtain a cure.

What impressed me as the most remarkable feature of the Byrne operation, especially when

compared with all other ordinary vaginal operations for cancer of the cervix, was the almost uniform absence of local recurrences. Byrne<sup>3</sup> says: "I have never known an instance of relapse in which the disease had returned in the part from which it had been originally excised. I have repeatedly observed the re-appearance of the disease in the fundus, ovaries, or some adjacent tissues, but I have never known a single instance in which the disease has reappeared on or close to the cauterized surface from which the cervix had been removed by galvano-cautery." He explains this by stating that "there is hardly any doubt that the developmental activity of the cancer cells or germs in certain stages, and under certain conditions, may be arrested or permanently destroyed by a degree of heat much below that which would be detrimental if not destructive to normal tissues." He is certain that the thermal agent exerts some modifying influence on the pathological processes much beyond and deeper than the surfaces actually cauterized, hence the importance of repeated applications, so that "every spot suspected of contamination may be thoroughly charred." He regards the black and charred wound cavity as "the best safeguard against the recurrence of the disease." The local mechanical effect of the cautery, consisting in directly destroying the cancer cells and by producing coagulation and necrosis, preventing a direct implantation into healthy adjacent tissues, seems to me scarcely a sufficient explanation of the evidently deep destructive action on the cancer tissues not in close contact with the heated instruments. It seems to me to justify the assumption that some chemical action is produced, some toxins, perhaps, which penetrate the deeper structures, and while not seriously damaging the normal cells, inflict permanent injury to the less resistant cancer cells.

For this work I have used both the Paquelin and galvano-cautery, but I consider the latter much preferable and more effective. In my experience, it is more difficult to get a thoroughly charred and an absolutely dry and black surface with the Paquelin than with

<sup>1</sup> Zur Frage der Heilbarkeit des Carcinoms, "R. Lomer in Ztschr. f. Geburtsh. u. Gynäk., 1841.

<sup>2</sup> Twenty Years' Experience in the Treatment of Cancer with Galvano Cautery, "Am. J. Obst., N. Y. 1889.

<sup>3</sup> Trans. Am. Gynec. Soc., 1888, p. 188.



the properly constructed dome-shaped galvano-cautery.

The excellent results obtained in these minor operations for cancer of the cervix by the galvano-cautery in the hands of Byrne, and others, impressed the writer to such a degree that he was induced, almost eight years ago, to employ it in the total extirpation of the uterus for this disease. If I may be permitted a little digression and a personal explanation in this connection, I will briefly refer to an operation which I had been doing up to this time (eight years ago), and which is still spoken of as the "Werder operation" in some of our American and English books on gynecology. The technique of this operation was practically the same in every detail as that described for the first time two years later, by Wertheim, in the *Archiv für Gynäkologie*. When I called Wertheim's attention to my description of the same operation, he frankly admitted my claims to priority in a personal letter to me and practically did the same in a communication to the *Archiv für Gynäkologie*, Bd 62. Since that time Wertheim has materially changed and improved the technique of the operation in so many respects, that I feel he is justly entitled to all the credit of the operation now generally known under the name of "Wertheim," all the more so since I have abandoned it for the cautery, for the reason that its mortality seemed too high, at least in my hands, and scarcely offset the gain in permanent cures resulting from it, and because I saw in the cautery a safer and, possibly, just as effective a means to successfully combat this disease.

The technique of the cautery operation since I first tried it has undergone many changes, but the principal feature, complete igni-extirpation by means of the galvano-cautery knife and Downes' electro-thermic clamps, has always been retained. The first nineteen operations were completed entirely through the vagina, assisted often by the Schuchardt incision, but since then I have adopted a combined operation, beginning in

the vagina and completing it by the suprapubic route. The difficulty of protecting the adjacent parts sufficiently, especially the ureters, during the application of Downes' heated clamps on the broad ligaments through the vagina, and the impossibility, at times, of deciding whether the case be a suitable one for radical treatment without abdominal exploration, induced me to adopt this change of technique.

The operation is preceded by a thorough curettement of the diseased surfaces, and cauterization until all oozing is controlled. The cervix is then firmly held by volsella forceps and an incision is made entirely around the cervix, as far as possible from the affected area, by means of the cautery knife, kept at a dull heat, to prevent oozing and rendering the wound dry. While making traction upon the cervix, the dissection is carried up carefully between the bladder and uterus, an assistant with a retractor drawing the bladder well away from the heated knife, until the peritoneum is reached, which is, however, not opened. Douglas' pouch is opened posteriorly by the same careful dissection, assisted by the index finger, and the lateral vaginal attachments are then burned through. The vaginal wound is now carefully inspected, and wherever the surfaces and edges do not look black and charred or show some oozing, they are gone over again, by means of a dome-shaped cautery, until they look perfectly dry and leathery. The vagina is then tightly packed with gauze and the patient's abdomen prepared for laparotomy.

A free incision is made between symphysis and umbilicus, and the uterus seized with a stout vulsellum forceps, after packing off the peritoneal cavity very carefully with gauze pads. The bladder peritoneum is incised from side to side, opening into the cavity previously made by dissecting off the bladder from the uterus through the vagina. A Downes' electro-thermic clamp is then applied to the right infundibulopelvic ligament and round ligament, the surrounding parts being carefully protected by the shield and additional wet pads, the tissues included in the forceps are then thoroughly cooked

<sup>1</sup>This operation was described by me in the Am J Obst, N Y, March, 1898, under the title of "A New Operation for the Radical Treatment of Cancer of the Uterus. Consisting of the Removal of the Uterus and Vagina en Masse by the Suprapubic Method," and was successfully performed for the first time January 5th of the same year. This patient is living and well at the present time.

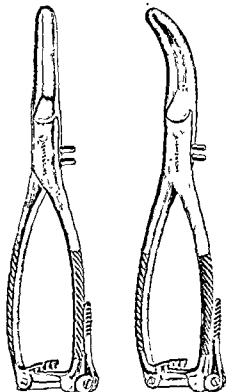
until a thin, white ribbon is obtained. The clamp is then removed and the ribbon cut through near its inner edge, and if, after a few minutes, no bleeding occurs, dropped. The other side is then treated in exactly the same manner.

This brings the operation down to the parametrium. By passing two fingers of the left hand through the opened Douglas' pouch into the vagina and grasping the uterus between the two fingers, one on each side of the cervix, the uterus is firmly drawn up and its parametrium made tense and more easily accessible. This is then seized, first on the least affected side, in a clamp, after the bladder and ureter on that side have been carefully protected and is then burned through, the ribbon thus made is cut through, and then another portion of the broad ligament and sacro uterine ligament is burnt in the same manner, thus freeing one side of the uterus from all its attachments. It is then a comparatively easy matter to treat the opposite parametrium in exactly the same way. If our technique has been good, not a drop of blood is lost, and the surfaces are all perfectly dry. If, however, we should find a bleeding point, either the burning may be repeated, or, if one of the larger vessels is bleeding, a catgut ligature would be preferable. With a little experience in this technique it will rarely be necessary to use any ligatures. A very important point is the thorough oiling of the inside plates of the clamps with sterile olive oil, the failure to do so will cause a baking of the tissues to the clamp which on opening will tear the ribbons and possibly bring on some bleeding. I have never seen any bleeding follow from a well-formed ribbon.

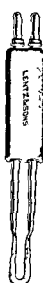
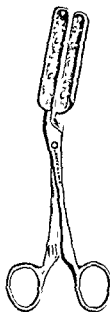
The stump of the vagina is now exposed, its cauterized edges inverted downward and approximated with a continuous catgut suture. Next the bladder is brought over the sutured stump of the vagina and its peritoneum stitched to the rectum posteriorly. The broad ligament stumps are carefully covered up with peritoneum on both sides, just as after a typical panhysterectomy for fibroid tumor. The abdomen is then closed without drainage. The abdominal part of the operation is practically that of an ordinary

panhysterectomy, with only this difference that the broad ligaments and parametria are clamped and burned, instead of tied with ligatures. No preliminary dissection of the ureters has thus far been made; for the exposure of the parametrium and for the protection of the ureters we have depended on firm traction upon the uterus and the sides of the bladder with two fingers hooked through the opening in Douglas' pouch over the cervix while the clamps are placed in position. Only one injury to the ureters has occurred since doing the combined operation and that did not manifest itself until about ten days after operation. When operating exclusively through the vagina there were two ureterovaginal fistulae as a result of heat necrosis, one of these was subsequently cured by an implantation into the bladder by myself, the other case had the kidney removed by another surgeon. In a few cases, however, I was obliged to expose the ureters freely down to their vesical insertion, enabling us to excise the parametrium more completely without fear of damage to these important structures.

During the last year the procedure just described has been slightly modified, by first amputating the cervix by the cautery knife, doing a fairly high amputation, accompanied by thorough cauterisation of all parts until complete hæmostasis is secured and a black, dry, charred wound surface presents itself everywhere in the roof of the vagina. The object of this is an endeavor to use more extensive and prolonged heat application to the vaginal surfaces, especially about the basis of the parametria, thus obtaining, in our opinion, a more complete and extensive destruction of the cancer elements in this particular field of operation. While this additional step takes up a little more time, it facilitates the subsequent intra-abdominal work considerably, especially in relation to the parametria. Another change is the use of ligatures for the infundibulopelvic and round ligaments, instead of the heated Downes' clamps, confining the application of the latter to the deeper structures in the pelvis, where cancer extension usually occurs, the upper portion of the broad ligament be-



Downes' Clamps



coming rarely, if ever, involved in the operable forms of carcinoma of the cervix. As ligatures can be applied much more quickly than the heated clamps, considerable time is saved by this modification, without detracting in any way from the effectiveness of the operation.

The regional glands in this operation, excepting in a few of the later cases in which enlarged glands could be distinctly outlined by the exploring fingers in the abdomen, have not been disturbed. While routine removal of the iliac glands is insisted upon by a large number of our modern operators, it is still an open question how much the patient gains by this additional tax on her vitality, and whether the results compensate her for the increased risk attending it. Wertheim's results, whose experience in this work has been larger than that of any other surgeon, have not been encouraging. Of the cases with multiple gland involvement they had only five

living at the end of five years. It is still undecided whether, after all, there is not some truth in the suggestion made from different sources that the gland contains some elements not only able to resist cancerous invasion, but also under certain conditions destructive to the cancer cells. On the other hand, by breaking into glandular structures and liberating the cancer elements, smearing them into the open connective tissues, as is unavoidable sometimes in their removal, we may be the means of laying the foundation for a subsequent cancerous infiltration in that region. At the present time, therefore, I am, along with many other gynecologists, very skeptical in regard to the utility of the routine removal of regional glands, especially so, as I have seen in a number of recurrences glandular involvement in the upper part of the abdomen, behind the kidney, and in one case involvement of the mediastinal glands and those of the neck. These experiences prove beyond a doubt that to remove all the glands liable to become affected in this disease is a physical impossibility; to extirpate the few accessible ones only seems scarcely worth the additional risk.

During the period of almost eight years in which we have been doing this operation of

igni-extirpation of the uterus, 78 cases in all have been operated by myself and my associate, Dr. Weiss. Only carcinoma of the cervix have been included in this number, for carcinoma of the corpus uteri either a panhysterectomy or a simple vaginal hysterectomy have given such satisfactory results that no change in treatment has been considered necessary or desirable. All cases of carcinoma of the cervix subjected to radical operations were treated by igni-extirpation during this period with exception of one, in which the uterus was extirpated without the cautery because an accident just previous to operation had put our electrical apparatus out of use for the time being. In another case a high amputation of the cervix by the galvano-cautery according to Byrne method was made, on account of the age of the patient, who was 67 years old. Neither of these two cases are included in this series of 78 cases. In all these cases the clinical diagnosis decided the treatment, but this diagnosis was subsequently confirmed in every instance by the microscope. In none of these was it necessary to depend on a microscopical diagnosis, as the cases were all sufficiently advanced to be readily recognized clinically as carcinoma. I mention this, not from lack of confidence in the pathological diagnosis, but because I consider a clinical diagnosis confirmed by the microscope as final and unquestioned. Our average percentage of operability during the last fifteen years, during which I have been doing the more radical operation for cancer, has been 38 per cent. In some of these cases we started out with the expectation of doing a complete extirpation, but after curettement and cauterization we found the disease too far advanced to proceed any further, in several the operation was abandoned after an exploratory laparotomy.

Four of the 78 cases died as a result of the operation. One, who had nephritis at the time and previous to operation, died three weeks later from uræmia. The second died six days after operation from a typical acute dilatation of the stomach. The third one succumbed two hours after operation from shock. It was a case with marked involvement of the iliac glands with deep infiltration

of the tissues and also extension to the bladder, which was badly torn during the enucleation. These complications, however, were not discovered until the operation was well under way, when it was too late to discontinue it. The fourth and last death occurred two weeks after operation, in a woman quite anæmic and enfeebled and in generally poor physical condition. She left the table with a very weak pulse and we had great difficulty in getting her to rally. She developed a hypostatic pneumonia at the end of the first week, to which she finally succumbed. This makes a primary mortality of 5.1 per cent, which compares very favorably with that of any other operation for this condition.

The most notable improvement in the operative mortality is unquestionably due to the absence of sepsis, not a single case has had any evidence of serious infection. In all my previous work in carcinoma of the cervix sepsis had been the cause of a large mortality. The same is noticeable in the work of others. Wertheim has an operative mortality of 93 in 500 cases, an average of a little over 18 per cent; of these almost half succumbed to septic complications. Schauta, who is an enthusiastic advocate of an extensive vaginal operation for cancer, has a mortality of 28 in 258 cases, or 10.8 per cent. Sixteen of these 28 deaths, or over half of them, were caused by septic conditions. The elimination of sepsis in our cases is not due to the preliminary curettement and cauterization of the diseased cervix, because that is done by Wertheim and Schauta, as well as practically all other operators, but must be attributed to the "cooking" process of the parametria, which, according to Liepman, is frequently the habitat of various pathogenic organisms in cancer of the cervix. By the thermic action of the clamps these are not only destroyed in the field of operation, but no large, open wound spaces are left for absorption and further development. In all other operations, no matter by what method, it will be very difficult to eliminate entirely this great danger of infection. As there is practically no loss of blood in this operation the danger of heart shock (so common in the radical procedure) is greatly minimized.

No	Name, Age, Date	Referred by Doctor	Operation	Results
1	Mrs L. 31, Dec 12, 1903	Stewart	Vaginal igni-extirpation	Death after three weeks from uræmia
2	Mrs V. 48, April 16 1904	Waide	Vaginal igni-extirpation	Death after four years from paresis. No recurrence
3	Mrs M. H. 66, April 18, 1904	Boyce	Vaginal igni-extirpation	Death after four years from recurrence
4	Mrs P. M. 47, May 11 1904	Werder	Vaginal igni-extirpation	Living seven and one-half years. Had amputation of cervix for cancer one year before radical operation was done
5	Mrs H. 53 June 18 1904	Graham	Vaginal igni-extirpation	Death almost a year later from recurrence in inguinal region. Site of operation clear
6	Mrs A. Y. 55 July 7 1904	Shields	Vaginal igni-extirpation. Implantation of left ureter into bladder about two years later (June 1906)	Death from recurrence in glands after two and one-half years. Left ureter severed at operation. Repaired two years later
7	Mrs C. S. 70, Sept 8 1904	Grube	Vaginal igni-extirpation	Death after six years from other cause. No recurrence
8	Mrs E. 53 Oct 27 1904	Goulding	Vaginal igni-extirpation	Living seven years
9	Mrs R. S. 39 1904	Werder	Vaginal igni-extirpation	Death after three years from recurrence in iliac region
10	Mrs W. 48 Jan 16 1905	Warnack	Vaginal igni-extirpation	Living almost seven years
11	Mrs K. 36 Mar 6 1905	Wood	Vaginal igni-extirpation	Death after five months from recurrence in vagina
12	Mrs J. H. 35 Mar 8 1905	Werder	Combined igni-extirpation. Repair of recto vaginal fistula two months later (May 18 1905)	Death after three months from suppression of urine. Recto vaginal fistula
13	Mrs W. McC. 38 Mar 21 1905	Alder	Vaginal igni-extirpation	Death after three years from recurrence in inguinal region. Site of operation clear
14	Mrs E. R. 40 April 16 1905	Matson	Vaginal igni-extirpation	Living six and one half years
15	Mrs LeC. 32 July 5 1905	Deans	Vaginal igni-extirpation	Death after one year from recurrence
16	Mrs M. C. 53 July 10 1905	Sayer	Vaginal igni-extirpation. Recto-vaginal fistula repaired two months later and again thirteen months later (Sept 1905 and Oct 1906)	Living six and one-half years. Recto vaginal fistula
17	Mrs J. C. 56 Oct 23 1905	Pollock	Vaginal igni-extirpation. Extirpation of recurrent carcinoma of vagina, eighteen months later (April 1907)	Death after four years from recurrence in bladder and vagina
18	Mrs M. S. 49, Oct 26 1905	Lewis	Vaginal igni-extirpation	Living six years. Vesico vaginal fistula still present
19	Mrs H. L. 49 Dec 15 1905	Lewis	Combined vaginal and abdominal igni-extirpation	Death after two years from recurrence. Right ureter severed at operation
20	Mrs Z. F. B. 54 Dec 20 1905	Gormley	Vaginal igni-extirpation	Living six years
21	Mrs J. W. 47 April 30 1906	Clark	Combined vaginal and abdominal igni-extirpation	Death from recurrence
22	Mrs D. P. B. 48 May 1906	Irish	Combined vaginal and abdominal igni-extirpation	Living five years. Health poor but there is no evidence of recurrence
23	Mrs S. F. 33 May 22 1906	Sturgeon	Combined vaginal and abdominal igni-extirpation	Living five and one half years
24	Mrs S. H. 51 June 18 1906	Müller	Vaginal igni-extirpation	Living five and one half years
25	Mrs J. E. 40, Sept 23 1906	Werder	Combined igni-extirpation. Repair of vesico vaginal fistula seven months later. Retroperitoneal cyst drained about three and one-half years later	Living five years. Had vesico-vaginal fistula. Repaired. Recurrence
26	Mrs G. W. 30 Sept 23 1906	Somerville	Combined igni-extirpation. Removal of fatty debris from abdominal wall thirteen months later (Oct 1907)	Death eighteen months later from recurrence in glands
27	Mrs A. P. 35 Sept 23 1906	Stanton	Combined vaginal and abdominal igni-extirpation	Death after one year from recurrence in other parts
28	Mrs J. M. 39 Oct 9 1906	Fridgeon	Combined vaginal and abdominal igni-extirpation	Death after one year from recurrence
29	Mrs W. S. 36 Nov 28 1906	McNall	Combined vaginal and abdominal igni-extirpation	Death after five years from recurrence

No	Name, Age, Date	Referred by Doctor	Operation	Results
30	Mrs F P J 47 Jan 30 1907	Jepson	Combined igni-extirpation	Vesico-vaginal and rectovaginal fistulae Death after two and a half years
31	Mrs J M 30 Feb 26 1907	Oliver	Combined igni-extirpation	Death after one and a half years cause not stated
32	Mrs P D 47, April 9 1907	Burns	Combined igni extirpation	Living five and a half years No signs of recurrence
33	Mrs F B 56 June 25 1907	Allison	Combined igni-extirpation	Living five and a half years No recurrence
34	Mrs C A 63 June 25 1907		Combined igni-extirpation	Death two weeks after operation from acute dilatation of stomach
35	Mrs O C 48 Aug 14 1907	Burchinal	Combined igni extirpation	Living and well after five years
36	Mrs C H L 57 Sept 24 1907	Emerling	Vaginal igni-extirpation	Living five years No signs of recurrence
37	Mrs W P S 55 Oct 20 1907	Shupe	Vaginal igni-extirpation	Both ureters sloughed vesico-vaginal fistulae from pneumonia one year later Death
38	Mrs C L T 54 Dec 9 1907	Titte	Combined igni-extirpation	Living five years No evidence of recurrence
39	Mrs F C 60 Jan 11 1908	Caldwell	Combined igni-extirpation	Death two years ago probably from cancer

Accidents to ureters and bladder and other adjacent organs are, I believe, with a little familiarity with the technique employed, no greater in the cautery operation than with other methods which strive to do a thorough radical extirpation of the uterus with a large portion of the parametria and upper portion of the vagina.

As it would be impossible, in the limited time at my disposal, to discuss at length all the cases in this series, I will confine myself very briefly to those whose operation dates back five years or longer, because patients who have survived five years may as a rule be considered permanently cured. The percentage of such survivals is, therefore, a fair test of what an operation has been able to accomplish to save life. We have fortunately been able to keep in touch with practically all our patients by receiving reports from them personally at irregular intervals, or through their physicians; I am, therefore, in a position to account for at least all the cases which come into this group. In thirty-nine cases five years or more have elapsed since operation. Twenty-one of these were vaginal igni-extirpation and eighteen combined. Of these, eighteen have survived the five-year limit, or 46 per cent. Five of these, however, have died since—one after six years from an intercurrent disease, and four from recurrence; one after six and a half years from carcinoma

of the liver, one after six years from involvement of retroperitoneal glands and spinal cord; one after five and a half years from recurrence in the lumbar glands, and one after five years, place of recurrence not known. That four deaths, 22 per cent, should have occurred more than five years after operation, when by a generally accepted rule the cancer victims should have reached the harbor of safety, is calculated to upset our present views concerning the prognosis of cancer operations, and would seem to necessitate an extension of the period of safety beyond five years.

Very little definite information can be obtained from a review of our statistics pertaining to such late recurrences, it is therefore not clear whether my experience has been exceptional and different from that of other operators, or whether less careful attention has been given patients who have passed the supposed danger limit. At any rate, such a large percentage of late recurrences should not fail to attract the attention of operators having a larger material at their disposal and lead them to make a thorough investigation of cases who have passed the supposed safety limit. Such an investigation would not only prove extremely interesting and instructive, but would be of considerable practical importance, as it would promptly solve the question which in view of my experience naturally presents itself, whether our views

concerning the prognosis of our cancer patients have been too optimistic and whether we are still justified in considering five years sufficient to pronounce a patient cured. It may be objected that, as one of these patients died five years after operation, she should not be placed in this group, because while she was living after five years she was not well at this time, but suffering from a far advanced recurrence; even if a second patient, whose death occurred five and a half years after operation and whose condition of health may be considered doubtful at the five-year period, were excluded, it would still leave two patients out of eighteen who certainly had no evidence of a return of the disease at this time, a sufficient percentage to justify a revision of our views hitherto held.

There are at present living and well thirteen cases,  $33\frac{1}{3}$  per cent, of these, three have lived eight years and more since the operation; three, seven years and more, two, over six years, and five, five years and over. Nine of the survivals were cases of vaginal igni-extirpation, and four combined. This leaves twenty-one cases whose death occurred within five years of operation, including the two operative deaths.

Of the nineteen patients who survived the operation twelve are known to have had a recurrence, the seat of recurrence being local in two, and in the inguinal, iliac and lumbar glands in ten. Two deaths were due to intercurrent diseases and in five cases cause of death is unknown. Death occurred within one year in seven, in two years in four, in three years in five, in four years in three. Eleven patients were less than forty years of age; of these only one is living at present. This seems to confirm the finding established by a number of experienced operators—that in carcinoma of the cervix, at least, age is of considerable importance from a prognostic point of view. Patients who have passed the menopause or are very close to that period are more favorable subjects for treatment than those during the height of their sexual activity. There seems to be no doubt that lymphatic extension occurs much earlier

and more rapidly in young patients than in the old, and this probably accounts for the difference in the prognosis.

A comparison of the permanent results in my cases with those of other operators shows unquestionably a very marked improvement over those obtained by all the older methods in which no special effort is made at resection or destruction of large portions of the parametria and the upper part of the vagina in proximity to the malignant neoplasm, with a primary mortality I believe considerably in favor of igni-extirpation. We have not, however, been able to reach the brilliant results reported by such men as Zweifel, Schauta and Wertheim, and other European surgeons. No American operators so far have equaled or even come near the percentage of cures credited to these men, though many of them have been employing the same methods and operative technique. There can be only one explanation of this, which is that in this country the material reaching the surgeon gives less favorable prognosis, because in the majority of cases the disease is further advanced, in fact has very often reached the border-line stage, where results must necessarily be more unfavorable, no matter what method of treatment is adopted.

Our urgent need is a systematic and energetic propaganda for the purpose of interesting the medical profession and instructing the American public in the cancer problem in a manner similar to that carried on in Germany so successfully for many years, and which has borne fruit to such an extent that instead of having an operability of 38 per cent, as in my case, and even less in the hands of many other American operators, the operability in many sections of Germany and Austria has exceeded 60 per cent. We have reached a point in the treatment of uterine cancer when little more is to be expected in the technical improvement of our radical operations, as they have almost reached the limit of surgical skill; our only hope for further improvement in our results of the radical treatment of cancer is an earlier operation

## DISCUSSION BY ROBERT L. DICKINSON, M. D., BROOKLYN

IT is most fitting and appropriate that this important paper on the cautery in the radical treatment of cancer of the cervix should be read in the city that was the home of John Byrne by the man upon whom his mantle has fallen. We pelvic surgeons of Brooklyn, who were taught by the genial gynecologist of St. Mary's Hospital and follow in his steps, regret that we cannot show so long an array of cases as Pittsburgh boasts, but we, too, hold strongly to the faith that no other operation can compare with cautery hysterectomy from certain points of view, and, like Dr. Werder, are trying to perfect the methods of carrying out this mode of attack. It is possible that the reason removal by cautery fell into disuse was the mechanical difficulty connected with the battery of Byrne. When it worked, it worked perfectly, but it took the knowledge of a Palmer as assistant to get constant results in heating the knife. All benzine-heated tips are clumsy and blunt. No reliable method of heating a flat platinum blade has been available until the electric current, harnessed to such an outfit as I here show, gave us a delicately adjustable yet powerful effect. There by the Byrne method comes into its own again, and we are able to drive home once

more the axiom of our great Brooklynite with his unmatched results, namely, that the ideal treatment of the broad ligaments is sealing of their lymphatics by a "deep dry roast."

The second betterment that would tend to restore the operation of Byrne is the addition to his operation of a relatively wide dissection of the broad ligaments with the cautery knife. Of this I shall show you a five-year example on the screen (Fig. 1). Such broad ligament removal is adapted to cases of beginning or suspected infiltration of the broad ligaments. In general, however, the following statement applies:

The theorem is susceptible of argument that *most cases curable are curable by lesser operations*. For such cases as I here show (Figs. 3 and 4) where only a small area of cervix was affected the typical operation of Byrne has given 5 years' immunity. The cervix with a small section of the vaginal wall has been

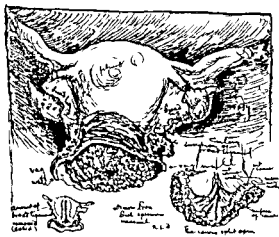


Fig. 1. Specimen drawn immediately after removal, showing amount of broad ligaments readily removed with cautery knife.

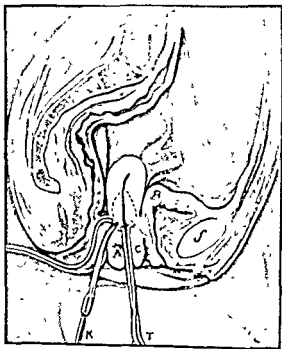


Fig. 2. Operation of Byrne, showing, by the dotted lines, portions of uterus removed. Applicable to very early cases only. Drawn for Dr. Byrne by R. L. Dickinson.



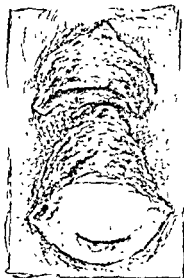


Fig. 3 Life size sketch of portions of uterus removed in two steps at one session. The whole of the cavity has been included. Drawn at once after removal. Five year case.

amputated in a cone shape the tip of the cone running up into the body of the uterus, as in Figs. 2 and 3 and up to the very fundus, as in Figs. 3 and 4. Thereafter the fundus itself may or may not be taken out, as one chooses.

I have removed the uterus, ovaries and

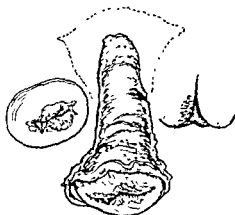


Fig. 4 Life size sketch of section removed by cautery, the first portion including the whole of the cavity. Very early case. Drawn at once. Five year freedom.

tubes, and considerable parametrium in one piece with the cautery without ligature save one strand on a large varicosity of the broad ligament, and without oozing. But this is a surgical stunt and not to be recommended. If in an early case one desires to remove tubes and ovaries two ligatures on each side are simple and sufficient and the abdominal wall need not be incised. I have had the pleasure of seeing Dr. Werder do his operation in Pittsburgh but inasmuch as the parametrium presents the danger zone of extension in cervix cancer, it seems to me that if a vaginal attack has been undertaken the whole work had better be completed through the vagina. The purpose of the cautery is to seal the lymphatics. The lymphatic channels which carry dangerous cells are those of the broad ligaments and are sealed by Dr. Werder in his vaginal work. The clamp on the ovarian and round ligament vessels of the upper third of the broad ligaments is, therefore, an unnecessary precau-

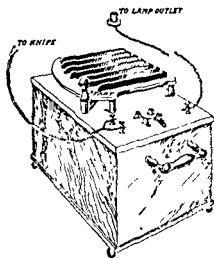


Fig. 5 Rotary converter used with Edison direct continuous current. A simpler apparatus is employed with the alternating.

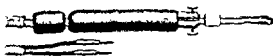


Fig. 6 Heavy platinum knife which retains its heat even in working in wet tissues.

tion against cancer located in the cervix and a considerable difficulty and complication. His clamp follows the method of Downes. Downes' clamp is a modification of the Skene clamp, adding to the power and ecraseur action of the original instrument. Again, therefore, the operation advocated by Dr Werder is, in its second step, a modification of a Brooklyn manner of hysterectomy, that with electric hemostatic clamps.

Moreover, to really affect cancer statistics, an operation should be advocated which is within the reach of the surgeon and gynecologist of reasonable skill, because the more formidable operation cannot be undertaken by him. And, lastly, consent to the vaginal operation may be obtained earlier and more often than to the radical abdominal operation, for we are obliged to state to the patient that the attempt from above is one accompanied by a high mortality.

We of the American Gynecological Club had the pleasure of seeing all the greatest operators of Germany, with one or two exceptions, do Wertheim operations, and I watched Dr. Wertheim carry out his own procedure more than once this summer. It should be said with the strongest emphasis that the Wertheim operation is an operation to be done only by the most expert abdominal surgeons, because the wide dissection of the ureters and the very great difficulty in handling the veins deep in the lateral pelvic wall demands large experience and masterly skill and delicacy, and calls for a brilliant illumination deep in the pelvic cavern by the electric arc beam, and even then the percentage of injuries to the ureter and the danger of peritonitis loom very large.

Earlier operation, vaginal operation, cautery operation—these are to my thinking, the direction of chief progress, over against the day of a successful serum, and even then the lesser operations will need to be combined with the far reaching injections.

The following data are added to make clear the discussion printed above.

*The apparatus* comprises two electrical devices. One is known as a rotary converter. This is used to transform the direct current into an alternating current. An alternating current may be trans-

formed far more easily than a direct current. Therefore, the alternating current is used. This alternating current from the rotary is in turn put through a closed circuit transformer. This closed circuit transformer steps down the voltage from that obtained from the rotary (about 75 volts) to about 20 volts. This 20 volt A C is obtained from the secondary of the transformer, and may be regulated from 0 to 20 volts. At the same time, in converting this higher voltage A C into a lower voltage A C we are also transforming the quantity of electricity from a lower amperage to a correspondingly higher amperage output, so that one is able to obtain a lower voltage and higher amperage. This then is used for heating the cautery knives (Fig. 5).

Between the transformer and the knife run particularly heavy cables, in order to lower resistance and to prevent heating. This applies especially to the wires running through the handle to the knife. This handle is very heavily insulated and does not heat up in a long operation. The absence of a switch in the handle seems to me also to make for lowered resistance and cooler structures, but some operators prefer such a switch in the handle.

The peculiarity of my knife, in which it differs from others, lies simply in its larger mass of metal. Thereby the lesser degree of heat is longer held, and thereby also in connective tissue planes the slightly curved blunt blade can push away structures like the bladder (Fig. 6).

The differences from previous apparatus, and practically the whole story of efficiency in this outfit, now about two years in use, depends on two things: a powerful rotary converter and a powerful knife connected by heavy wire. Little knives and thin knives cool quickly, and, in consequence, the operator heats them far too hot, so that the tissues are charred instead of being cooked to horn. A black scab on the end of a vessel is knocked off by the blood current or the retractor. The tough, white stiff surface, feeling and looking like horn or rubber, is the tissue to leave in the track of the knife. Thus he who has used the method a few times is not afraid to cook the uterine, and trust to the cooking to hold the vessel, but the beginner will sleep better with ligatures about these big vessels.

The outfit is made by the Wappler Electric Manufacturing Company, of New York.

*Steps of the operation.* Byrne worked with the patient in Sims' posture in order to secure a ballooned vagina and save anterior wall retraction. I prefer the dorsal posture because the anatomy of the broad ligaments is more easily kept in mind.

Rotten tissue may be curetted from the cervix cavity and iodine or pure carbolic acid swabbed over the surface and the cervix closed by sutures or clamps. In early involvement Byrne's method of spreading his instrument in the canal gives a steadiness of hold and a facility of manipulation possessed by no other measure. The cuff of the vaginal wall is dissected back widely when the growth has attacked a portion of the cervix near the vaginal

wall. Where the disease is in the canal alone this is not essential and the dissection may begin near the cervico-vaginal junction. Dragging downward on the uterus and making counter-traction so that the line of incision is taut, the knife is pressed firmly against the vaginal wall, which must turn white for a few millimeters each side of the cut. Charring is to be avoided as far as feasible and also bright redness of the platinum. The perpetual refrain of this operation must be that of Byrne—"less heat" "less heat," "a deep dry roast," "a deep dry roast." The constant fault is too much heat and, as I have said and must continually reiterate, this is unavoidable with light knives and small conducting wires. The attendant keeps his hand upon the switch and the operator calls for more or less current according to the density of the tissues and their vascularity.

As soon as the vagina is freed, progress in the loose cellular tissue in front or behind the cervix goes rapidly—one dissects and one shoves. The slight curve of the knife and its blunt edge clear away the bladder rapidly. The posterior section is freed to

the cul-de sac. We next have the flat band of the broad ligaments to handle. Keeping away from the uterus and a safe distance from the ureter, the base of the broad ligament and the uterosacral ligament are cooked and severed. As we approach the uterine it may sometimes be dissected out by the knife, not too hot, and then carefully cooked, not with the edge, but with the flat of the knife. As is well known, the desired traction pulls into the field and away from the ureter a short length of uterine artery comparable, in a way, with what is removed by dissection. At this point the ligature may be placed if desired. The ureter may be dissected out. The cautery knife then frees the broad ligament to its thin upper portion. Great care—and this is most important—must be taken by the assistants not to use lateral tractors against the severed lower parts of the broad ligament, lest they drag the vessels open, if these have not been ligated.

The uterus now being free below, the rest of the proceedings, in my judgment, may better be by ligature, if one proceeds to take out fundus or adnexa.

## THE EXTENDED VAGINAL OPERATION FOR CANCER OF THE CERVIX UTERI<sup>1</sup>

By GEORGE GELLHORN, M. D., St. Louis

Associate in Gynecology, Washington University. Gynecologist to St. Louis City Hospital, Barnard Free Skin and Cancer Hospital, and St. Luke's Hospital.

SINCE methodical researches into the location of recurrences after operations for uterine cancer have established the fact that in about 90 per cent of the cases the disease recurred in the parametric and paravaginal tissues in close proximity to the vaginal scar, the simple hysterectomy, abdominal or vaginal, has lost all justification in cancer of the cervix. The only logical conclusion from these investigations was to find means by which this seat of predilection of cancer recurrences could be eliminated. The object in view was accomplished by so called "extended" operations, of which two types sprang into existence—the abdominal, devised by Clark, Ries, and Rumpf and perfected and popularized by Wertheim, and the vaginal with which I wish to deal in the following.

The dawn of this extended vaginal operation dates back as far as 1893, when Schuchardt (1 and 2) devised a deep lateral incision

through the pelvic floor by which an easier approach to the cancerous uterus was afforded. The untimely death of Schuchardt prevented this operator from further developing his method, but his idea was enthusiastically taken up and perfected by Schauta (3), who in 1908 presented to the scientific world a method more radical than its source and so original in many points that we may well term it the Schauta operation. The underlying principle in the method is this—to remove the greater part of the vagina and all of the parametric tissues together with the uterus. The question of removing the pelvic lymph glands is not taken into consideration in this method—a point which we shall have to discuss later.

Within the scope of this brief review only a general outline of the technique of Schauta's operation can be attempted. Those who wish to study the method more closely with the view of applying it in practice will find all

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America in New York, November 12, 1912.

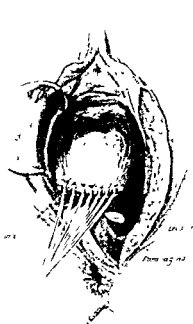


Fig. 1

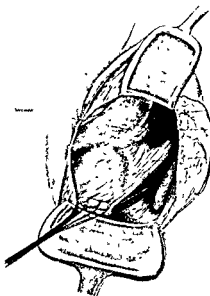


Fig. 2

necessary details in Schauta's extensive monograph entitled "Die erweiterte vaginale Totalexstirpation des Uterus bei Kollumkarzinom" (4).

After a thorough excochleation and thermocauterization of the cancerous area the operation proper begins with

*Step 1. Circumcision of the vagina.* Six or eight volsella are placed around the circumference of the vagina near the introitus and distal from these a circular incision is made through the vaginal wall. The vagina is now dissected off in an upward direction for several centimeters.

*Step 2. Formation of vaginal cuff.* Then by a "cuff" is formed which is closely sewed up by strong silk sutures that take the place of the volsella. The upper portion of the vagina with the cancerous crater is thus shut off and contamination of fresh operative wounds is prevented. The long ends of the sutures are tied together and serve as guy ropes during the following steps of the operation for which fresh instruments and gloves are to be used (Fig. 1).

*Step 3. Separation of the bladder.* The dissection of the vagina is carried still farther upward until the vesicovaginal septum is reached. If the disease does not extend too far the bladder can readily be loosened, if need be a small portion of the latter may be resected and the wound closed immediately. If a larger portion of the bladder be involved the case

must be considered inoperable since the experiences of all operators coincide as to the unfavorable results both primary and late of extensive resection of the cancerous bladder. We have thus at our disposal a criterion as to the operability or inoperability of a given case at an early stage of the operation while it is yet time to stop without more serious damage.

*Step 4. Paravaginal incision.* Not until this most important question has been settled is the field of operation laid open by the so-called Schuchardt incision. This incision starts from the vaginal circumcision at the juncture of left and posterior vaginal walls, extends laterally to the lower end of the left labium minus, turns now downward and parallel to the rectum and finally curves inward so as to encircle the left circumference of the anus and to terminate near the median line behind the anus.

The incision thus splits the paravaginal and pararectal tissues, the levator ani and coccygeal muscles, the cellular tissue of the ischio-rectal fossa, as well as the skin of the perineum and of the lateral anal region down to the sacrum. The wound in the pararectal tissue is situated to the left only so far that the rectum and sphincter ani are not injured. Left-handed operators will find an incision on the right side more convenient. Spurring arteries are ligated at once, venous bleeding is usually copious, but is readily controlled by a thick gauze compress held in place by a weighted speculum.

The effect of this incision is surprising. Instead of a vaginal tube, we have before us a shallow exca-

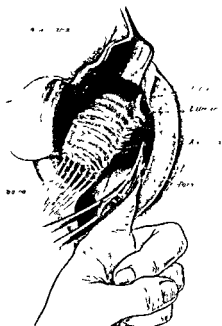


Fig. 3

vation not deeper than one inch and at the bottom of this the parametria are seen in full extent and within easy reach.

**Step 5 Dissection of ureters.** This is at once the most important and most difficult part of the operation, but it can be done in approved surgical fashion and under constant guidance of the eye. The uterine artery and vein lying above and behind the ureters are ligated and severed. This releases the ureter which during the subsequent steps of the operation is held upward together with the bladder, by a suitable retractor, and thereby protected from injury (Fig. 2).

**Step 6 Excision of the parametria.** The cul-de-sac of Douglas having been opened in the usual way, the two parametria are excised close to the pelvic wall. As the uterine artery has been ligated previously, there is as a rule active bleeding only from branches of the median hemorrhoidal artery which supplies the sacro-uterine ligaments. This requires ligations, while the venous bleeding is checked by firm tamponade of the deep cavity on either side (Fig. 3).

**Step 7 Removal of the uterus and closure of operative wounds.** The rest of the operation differs but little from any ordinary vaginal hysterectomy. Schauta suggests the leaving behind of the ovaries if they are normal. The peritoneal cavity is closed carefully the stumps of the broad ligaments having

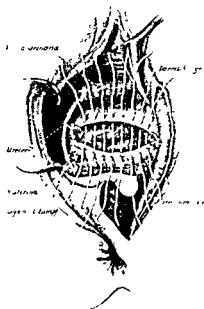


Fig. 4

been drawn downward and fastened extraperitoneally. The large wound cavity beneath the peritoneum is loosely packed with gauze. The paravaginal incision is closed with buried and superficial sutures. Contrary to Schauta I have so frequently observed fat necrosis that I am now in the habit of inserting a cigarette drain in the lower angle of the wound (Figs. 4 and 5).

It is at the request of your secretary, Dr. Franklin H. Martin, that I have ventured to describe to you the various steps of this operation, which judging from the dearth of American literature, seems to be practically unknown in this country. My personal feeling in the matter is that the recommending of the Schauta operation is not a promising undertaking. Vaginal operations have fallen into disuse, and abdominal methods alone are popular at the present time. To the growing generation of operators, vaginal technique is fast becoming a terra incognita. Yet if we claim for ourselves the distinction of specialists, in a class with the gynecologists of other countries where the line of demarcation from general surgery is more sharply

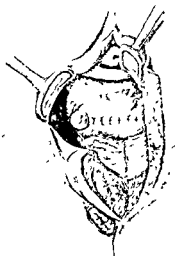


Fig. 5

defined than in America, we must needs familiarize ourselves with every therapeutic procedure which has proved of value in our particular work. In medicine there exists not a single technical method which is applicable in all cases. As gynecologists we cannot afford to adapt the patient to the one method which we may happen to know, but it is obviously our duty to vary the method according to the needs of the individual case. As regards the operative treatment of uterine cancer, even the most enthusiastic advocates of the radical abdominal method — Wertheim (6), Franz (7), Kulanyi (8) and others — admit that the latter because of its high mortality is contraindicated in fat patients, in women beyond the age of 60, and in those greatly reduced in strength by cachexia, sepsis or heart disease.

Here then is a legitimate field for the Schauta operation, for its primary mortality is strikingly lower than that of the extended abdominal operation. For the purpose of comparison, equally large series of either operation performed by operators of equal experi-

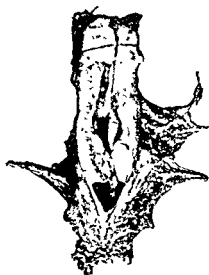


Fig. 6

ence should be considered because thereby most of the objections against arguing from statistics are obviated.

TABLE I PRIMARY MORTALITY

	Vaginal			Abdominal			
	Operated Cases	Deaf	Percent		Operated Cases	Deaf	Percent
Schauta	294	44	8.8	Wertheim	500	91	18.6
Schauta (last)	212	10	4.6	Wertheim (last)	200	21	12
Thom	96	5	5.2	Doehrlen	141	24	17.9
				Burns	111	18	16
				Rothorn and Knauer (11)	117	16	14.5

While this table shows the lesser danger to life from the Schauta operation, it may be argued that by the extended vaginal method we cannot remove as much of the parametrial tissues as by the abdominal radical operation. This may be true theoretically, but if we compare actual specimens obtained by either method, we will find that the difference is but slight (Figs. 6 to 8) — so slight, indeed, that the greater primary mortality of the abdominal operation in fat, cachectic, or very old patients outweighs the objection.



be superfluous, not to mention the influence it may exert upon the primary mortality. There are now but few dissenting views on this proposition, which I upheld in the American Gynecological Society more than seven years ago (13).

This point of opposition, then, being eliminated, the two methods no longer differ in essential principles. Instead of being antagonistic, they complement each other. If we are familiar with both, we are in a position to employ individual treatment in the individual case.

For reasons given above, the vaginal method lends itself, most of all, to the rather large category of old, fat, or cachectic patients and those suffering from heart disease. In very early cases of cervical cancer, both methods should be considered on equal terms. In squamous cell cancer, the vaginal operation should be given preference; in adenocarcinoma, the abdominal method. In moderately advanced cases, where the uterus is not freely movable, the abdominal operation should, in my opinion, be the method of choice. In this latter class of cases, where the uterus does not follow downward traction and the ureters are surrounded by cancerous tissues, the vaginal method meets with excessive difficulties, and consequently yields poorer ultimate results.

Thus far we have only considered the *relative* percentage of cures. The following table shows the *absolute* percentage of cures; that is, the proportion between the number of cases free from recurrence after five years and the total number of cancer patients admitted to hospital and dispensary for the same length of time.

TABLE III. ABSOLUTE PERCENTAGE OF CURES

Vaginal	Per Cent	Abdominal	Per Cent
Schauta	16.4	Burns	16
Thorn	19.5	Doederlein	17
		Wertheim	18.5
		Zweifel	18.4
		Kronst	23.3
		Franz	27.5

This difference in the absolute end results finds its explanation in the difference of

TABLE IV. OPERABILITY

Vaginal				Abdominal			
	Total of Cases	Operated Cases	Per cent		Total of Cases	Operated Cases	Per cent
Schauta (5)	1 007	498	54	Wertheim (6)	1 096	500	50
Schauta last 3 yrs			50-70	Wertheim last 2 yrs			61.9
Thorn (10)	217	96	44.2	Doederlein (14)	211	120	50.7
				Burns (15)	218	133	60.0
				Zweifel (17)	222	115	51.8
				Franz (7)	224	200	89.3

This greater percentage of operability is due not so much to the fact that infiltrated parametria can be excised more fully from above than from below, as to complications which would ipso facto call for abdominal intervention. Schauta and Thorn mention, under this heading, pregnancy, fibroid, hernia, ovarian cystoma, and tubo ovarian tumors.

Franz (7) claims that the more cases operated upon, the more cases will be cured. Mayer (14), on the other hand, remarks that a low percentage of recurrences is proportionate with a low percentage of operability; if the latter rises, the number of recurrences increases in equal proportion. To give but one concrete example. Franz subjected 82 per cent of his cases to the abdominal operation; Thorn 44.2 per cent to the vaginal method. Yet Franz had only 27.5 per cent of absolute cures in contradistinction to Thorn's 19.5 per cent. In other words, while Franz operated on almost twice as many cases, he had only 8 per cent more cures than Thorn. Under these circumstances, and further realizing that the results of Franz are thus far the very best obtained by anyone, can we still subscribe to the statement that the abdominal operation is the only one justified in cervical cancer?

In this greater percentage of operability there are included very far advanced cases, in which the infiltration of the parametria has extended close to the bony wall of the pelvis. Granted that in some few cases this infiltration may be but inflammatory in nature, the probability exists that in the vast majority of instances it is due to cancerous invasion. Even though in such "border-cases" the operation may be possible from a purely technical standpoint, I believe that cases should be excluded from any opera-

The illustrations in this article were taken from Schauta's monograph "Die erweiterte vaginale Totalextirpation des Uterus bei Kollumkarzi-



tion, whether abdominal or vaginal. The surgical axiom has been firmly established that when dealing with cancer we must operate in healthy tissue well outside of the affected area. In such far advanced cases of uterine cancer the observation of this general surgical rule exists only in theory. In reality, we have usually been forced in such cases to place our incisions in closest proximity to cancerous masses, and if the patient did not die at once, the inevitable result has been a speedy recurrence, or more correctly, a continued and even more rapid growth of cancerous tissues that were left behind. The oft-expressed idea of giving such patients the benefit of the doubt appears to me a fallacy. As a general proposition, they are worse off after the operation than before. Their morbidity, including accidental injuries, is greatly increased. In contradistinction to others, I have almost invariably found their recurrences much less amenable to palliative treatment than the primary tumor in cases in which no hysterectomy had been attempted. The psychic effect of an operation in such border line cases is all too ephemeral. Hopefulness and encouragement give way to even deeper despair when, so soon after the pain and anguish of an operation, the old symptoms reappear with increased force. If we consider not only the pitifully small group of cases which might perhaps be cured, but also the very much larger number of patients that are not benefited, we will, for the present at least, not persist in an extensive radicalism. These cases can be made comfortable and their lives prolonged by palliative means if only our aim is directed towards the elimination of bacterial infection of the cancerous area. From the study of a sufficiently large material I have arrived at the conclusion that it is the mixed infection, with streptococci or staphylococci, which renders the lot of cancer patients so deplorable. This mixed infection once removed, the clinical picture of cancer loses many of its dreaded features for a considerable length of time, and then these advanced cases, taken as a whole, are better off under palliative treatment than after having been subjected to a dangerous and unpromising operation.

Yet one must agree with Thorn (14) when he says that this extreme radicalism has served a certain purpose. It has proved to us that by extending the limits of operating to the utmost, the coveted goal cannot be reached. Only the future will show whether the educational campaign which is being so universally waged in Germany and other European countries and here and there in our country (for instance, by the Barnard Free Skin and Cancer Hospital in St. Louis) will yield appreciable improvement in our final results.

The days of passionate partisanship for one or the other method seem to be about over, and the time is ripe for a more quiet and objective discussion. Until the long hoped for cancer remedy is discovered along biochemical lines, we may succeed in reducing our primary mortality and obtaining a greater percentage of cures in the patients operated upon if we do not unduly extend our operations to far advanced cases, and if we individualize more carefully than in the past, and select from the methods at our disposal the one which offers the best chances in a given case. The arguments presented in the foregoing may thus be condensed in the statement that both the vaginal and the abdominal extended methods have their place in the operative treatment of cancer of the cervix uteri.

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## DISCUSSION BY HOWARD CANNING TAYLOR, M. D., NEW YORK CITY

AN operation for carcinoma of the uterus may properly be performed to accomplish one or more of three ends — we may operate to save life; we may operate to prolong life, we may operate in order to make the patient's life more agreeable, more bearable, and more satisfactory to her, and I might say also to her friends. In considering any operative procedure, we must consider the possible benefits along all three lines.

Speaking in general, the operation indicated for any carcinoma is the most extensive and most radical operation possible that is not associated with too great a risk to the patient's life, and which is not followed by too great deformity or interference with functions. This rule applies to carcinoma of the uterus as well as elsewhere.

In regard to carcinoma of the uterus, any deformity or interference with functions can be at once ignored, as we have only to consider the risk to the patient's life. When we consider the risk of the operation to the patient, we must remember that we are giving the patient her only chance, and no one with a real knowledge of the conditions of carcinoma of the uterus would hesitate to take the greater risk, if by doing so there is a corresponding greater chance of a permanent cure. There is, however, a risk beyond which it would not be right to go, and it is our problem with each individual case to determine, bearing in mind the risk to the patient and the chances of a cure, what it is best to do. In my opinion, for the case that is considered operable there is a reasonable operative risk, the operation elaborated by Wertheim, and described to-night by Dr Weibel, is the operation usually indicated. So far as the risk to the patient is concerned, we have statistics from operators abroad, as well as statistics from a number of operators in this country, to prove to us that the risk is not so great that it cannot be assumed when we know the possible result. I have myself performed the operation enough times so that I will not hesitate to do it in a case that is in fair surgical condition.

Regarding the vaginal hysterectomy for carcinoma of the uterus, as advocated by Schauta and described to night by Dr. Gellhorn, I am very glad that I had an opportunity this past summer to see it done in Schauta's clinic. It certainly is a remarkable operation, and I was surprised with the exposure of the parts and the ease with which the ureters were isolated and freed from the connective tissue. I was surprised, too, at the amount of pelvic tissue that it was possible to remove through the vagina. In doing the vaginal operation there is no possible opportunity of removing the pelvic glands, and cases have been reported by good authority where pelvic glands have been removed and the patient remained well beyond the five-year period. These cases would certainly have been lost if a vaginal operation had been performed. Of the two, there is no doubt that the vaginal operation is the more difficult one to perform, and it would require considerable experience before one could do the operation as thoroughly as it is done in Schauta's clinic. I would reserve the vaginal operation for very fat women, when the Wertheim operation would be associated with special risk, or in the cases with complete prolapse.

I have had no personal experience in the operation as described by Dr. Werder, but it does not seem to me that it can compare with the operation as described by Professor Wertheim. His statistics, of course, are very fine and I doubt if there is another operator in this country who has such a large percentage of cures at the end of five years, even when we consider his low percentage of operability. When we consider the different steps of an hysterectomy through the abdomen, the infundibulopelvic ligament and the round ligament are divided at such a distance from the growth that it is immaterial whether they are divided with the cautery or with the scissors. Recurrence rarely occurs there. The part that is most likely to be the seat of a recurrence is in the cellular tissue at the side of the cervix. Certainly the Wertheim operation, where the connective tissue is removed out as far as the pelvic wall, removes

more tissue than is removed or affected by the heat of the cautery. In the more advanced cases, where it would be necessary for Dr. Werder to dissect free the ureters in order to apply the clamp, either he must do what is done in the Wertheim operation, that is, dissect first with the scissors, or else he does not get as far away from the disease as is done in the Wertheim operation. In certain of the advanced cases it would be impossible to apply the cautery clamp at all, and these are evidently considered inoperable by Dr. Werder, although they might be undertaken by one doing the Wertheim operation, as his percentage of operability is decidedly lower than that of men who favor the Wertheim operation. He, of course, does not consider the pelvic glands at all. It was my good fortune last year to see Dr. Werder do one of these cases by his method, and I appreciate the skill with which he did it, and I appreciate the quality of the statistics which he has supplied to us.

The cancer problem as it exists to-day consists of two separate factors. The one is to discover the cause of the condition, together possibly with a serum or other agent that will effect its cure. The other is to use the knowledge which we already have to the best interests of our patients. The former is more directly connected with laboratory work; and although it is more than possible that a clinician may have much to do with the discovery of the cause of cancer, it is not part of our consideration to-night. To-night we are considering how we can best use the knowledge and information that we now possess so that we can accomplish the greatest good to the large number of women who are suffering or who may in the future suffer from cancer of the uterus. The first and most important step is to get the patient at the earliest possible time. It does not make any difference what operation is performed; unless the patient is seen and brought to operation while the disease is in its relatively early stages, there is no chance of saving her life. There is no doubt that the difference in the statistics reported from abroad and the statistics of the American operators is due in part to the difference in the stage at which

the case comes to operation. From the figures furnished me from the New York Board of Health early this year, I learned that, of the cases recorded at the Board of Health as having died of carcinoma of the uterus, there had been no operation other than a palliative cauterization in 75 per cent, and in only 25 per cent had there been an hysterectomy. Of these 25 per cent, undoubtedly a large proportion were operated upon, not with any idea on the part of the operator that he was going to permanently cure his patient, but with the idea of prolonging the patient's life or relieving her symptoms. I do not myself believe that even here in New York, where conditions are comparable to those in other large cities, one case in twenty of carcinoma of the uterus is operated upon at a time when there is any real chance of permanently curing the patient. Certainly my own individual experience would not make the percentage higher. If this is true in the city, where we have active hospital services ready to take these cases when we can get them, what must it be in the smaller outlying communities? To get our cases of carcinoma of the uterus earlier, it is necessary that our physicians recognize the importance of the early symptoms and the necessity of a thorough examination when the patients first apply to them. It is also necessary that our women be taught the early symptoms of carcinoma of the uterus, and the fact that an operation is a possible but the only cure, so that they will consult their physicians at once. We are just beginning to teach women at large—partly by lectures, partly by articles in popular magazines, partly through nurses and physicians—to know the early signs of carcinoma of the uterus, but we have not yet done all that we should do, and until we do more we are not going to reach women early enough to affect these statistics. Beyond question, therefore, our most important work is to so inform women at large that they may know the early first symptoms of carcinoma of the uterus, so that they will come to us at a time when it will be possible for us to hope to cure them.

During the past summer, while in Germany and Australia, I saw a number of cases of

carcinoma of the cervix operated upon. I saw two cases where no attempt at removal was made after the abdomen was opened. I saw one case that was comparable in its extent to cases that come under my own observation. All the other cases, six or eight in all, were earlier than most that I see and consider operable, and earlier than those

operated upon by such men as I have seen operate on carcinoma of the uterus here in New York. If it is possible for the medical profession in Germany and Austria to so educate their women that they get their cases of carcinoma of the uterus early, then it is possible for us to do so, and we are neglecting our medical duty if we neglect it.

## RESULTS AFTER THE WERTHEIM OPERATION FOR CARCINOMA OF THE CERVIX OF THE UTERUS<sup>1</sup>

A PRELIMINARY REPORT FROM THE GYNECOLOGICAL CLINIC OF HOWARD A. KELLY, OF THE JOHNS HOPKINS HOSPITAL

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ALTHOUGH the radical abdominal operation for patients suffering from carcinoma of the cervix of the uterus was advocated as early as 1895 by Clark and Ries, and in 1898 by Wertheim, before 1900 very few cases had been treated by this method in this clinic. Since 1900, however, in practically all the operative cases, the abdominal route has been employed, and the results here given are based upon such cases from January, 1900, to January 1912.

### TYPE OF OPERATION

Although the original operation still remains the same in its fundamental principles — the wide excision of the uterus with the parametria, and the removal of the surrounding lymph structures en masse — from time to time various modifications have been adopted in order to render the technique more perfect. It does not come within the limits of this paper to discuss these modifications; suffice it to say here that the operation as done in Dr. Kelly's clinic corresponds to that described and practiced by Wertheim.

### PERCENTAGE OF OPERABILITY

Inasmuch as we possess no means of determining the absolute progress of the disease, in the majority of cases the decision as to

suitability for the radical operation must depend upon the degree of direct extension of the local lesion. Judged by this standard, in the series of cases reported by Cullen from 1893 to 1899 the percentage of operability was 51.7. During the last five years, 125 cases of carcinoma of the cervix of the uterus have been admitted to this clinic. One patient refused operation. Of this number the radical abdominal operation was done in 67 cases, thus giving a percentage of operability of 54.

It is somewhat discouraging to note that, although more than a decade has passed, the percentage of operability has remained practically the same. Great efforts are being devoted to the working out of the operative technique, but unfortunately its successful employment is tremendously handicapped by the failure to recognize the early symptoms. The usual history given by these patients is that they have suffered from irregular bleeding for from seven to nine months, and have submitted to various treatments.

Nevertheless, the incessant campaign, waged more especially by Winter, is bringing forth encouraging results. Is it not time that concerted devotion and earnestness, similar to that used in fighting tuberculosis

<sup>1</sup> Read before the American Gynecological Association, May, 1912.

so successfully, be organized to save these patients, who are otherwise irretrievably lost?

#### STATISTICS

From January, 1900, till January, 1912, the radical abdominal operation has been performed in 136 cases; of this number, primary death occurred in 28 cases, giving a total primary mortality of 20.5 per cent. During the last five years, 125 cases have been admitted, out of this number the radical abdominal operation has been done in 67 cases. Primary death occurred in 8 cases, giving a primary mortality of nearly 12 per cent.

In 70 cases a period of five or more years has elapsed; of these patients, 61 have been traced and 9 lost track of; one patient died two years later from pneumonia, 14 are alive and well, while the remainder gave practically unmistakable evidence of recurrence. The percentage of permanent cures, based upon the number of cases in which the complete operation was done, excluding those lost track of, is 23.3 per cent. While granting that those 9 patients lost track of died from a recurrence, the percentage of permanent cures is 20.3 per cent. Of these 70 cases, primary death occurred in 20. Hence, if we deduct from the total number of cases operated on the number of primary deaths (20), the number dying from other causes (1), and the number lost track of (9), we get a percentage of cures in 35 per cent of the cases.

#### PROCEDURES TENDING TO LOWER PRIMARY MORTALITY AND MORBIDITY

The primary mortality, comparatively speaking, has been universally high; chiefly because, owing to their generally weakened condition, the patients were unable to stand such an extensive operation. Primarily, as in all operations, the first duty of the surgeon should be directed to the immediate results to the patient, since there can be no consolation in the much-quoted remark, "The operation was successful, but the patient died." Hence, any procedure which will lessen the time required for the operation, the immediate shock, and yet guarantee the

same thoroughness, should be employed in every case.

1. *Disinfection of the growth.* Although it is doubtless impossible to render the carcinomatous area aseptic, there is much to be gained from proper measures along these lines. For several months the following technique has been employed here:

a. The usual perineal and vaginal cleansing—soap and water, bichloride of mercury (1:1000), and alcohol, 70 per cent.

b. Thorough cauterization of the primary growth with "soldering irons" or the Paquelin cautery.

c. The application of benzine iodine solution (1:1000 iodine) to thoroughly dehydrate the field.

d. The application of tincture of iodine (3.5 per cent).

e. An iodoform gauze pack placed in the vagina.

After a thorough cauterization of the growth, the cervical canal should always be dilated. Occasionally, this procedure brings to light the existence of a pyometra, which is an absolute indication for postponement of the operation.

As yet the series of cases treated in this manner is too small to warrant conclusions, but it is of interest to note that none of these patients has subsequently developed peritonitis.

2. *The incision.* In all these cases a long midline incision has been employed. In very fat patients, the resection of an ovoid area of skin with the subcutaneous fat in the midline (horizontal lipectomy) has been found to be of great advantage. By this method the depth of the field of operation is reduced by from 5 to 7 cm, and the ultimate result adds greatly to the general personal comfort of the patient.

3. *The catheterization of the ureters.* Although the use of ureteral catheters has not been followed uniformly, there has been no hesitancy in their employment. With the greater facility of catheterization incident to the improvement of cystoscopic technique, this procedure can be carried out within a few minutes before the general anæsthetic is given, and will prove to be of the greatest

possible assistance during the course of the operation. It is especially satisfactory in obese patients, where the exposure is difficult, since it lessens the time necessary for the isolation of the ureters and renders comparatively easy the control of hæmorrhage from the vaginal plexus of veins, which in many cases is the most troublesome part of the entire operation.

From a study of our cases we are led to conclude that the liability to ureterovaginal fistulæ, or secondary infection of the urinary system, is not increased by this procedure. However, the following cautions should be observed:

a. The minimal amount of manipulation, with least possible trauma, is to be exercised.

b. The ureteral sheath should not be disturbed at any point.

c. The catheters should be removed when the ureters are completely isolated, and further manipulations should consist in rolling the ureters over, with the least possible disturbance to their blood supply.

4. *The lymphatic glands* As it is generally conceded that the lymphatic glands are implicated in from one third to one half of all operable cases, and since we have no means of determining that involvement except by microscopic examination, theoretically speaking, the ideal operation would include their resection in all cases. However, the present operative facilities and technique do not justify such an extensive operation, on account of the great increase in the primary mortality following such a procedure. Hence, for many years no attempt at removal of the lymph structures other than those of the parametria has been made.

5. *The resection of the vagina* After the thorough dissection of the parametrial and vaginal tissues to a point well below the extent of the growth, they are resected, after the vaginal canal has been swabbed out to remove any infected accumulation. With a thorough preliminary cauterization, the widest possible resection, with probably the least risk of immediate danger to the patient, is obtained by the use of sharp dissection.

6. *Pelvic closure.* As in all abdominal operations, denuded areas should be closed

over as completely as is permissible. By this step of the operation the liability of post-operative intestinal obstruction is reduced and the injury to the ureters greatly lessened.

On account of the possible infection present in all cases, some form of pelvic drainage is to be advised. In this clinic the most satisfactory drainage has been obtained by a small cigarette drain, composed of gauze surrounded by rubber protective, placed through the vaginal opening.

7. *The postoperative treatment.* Aside from the general measures for combating shock, there are many procedures which may contribute to a smooth convalescence. The excessive trauma to the bladder walls almost invariably causes temporary vesical paralysis, and formerly it was not unusual to catheterize a patient from thirty to forty times. For the last eight months the preoperative treatment has been varied, so that all patients have water forced until they go to the operating room. This, together with the forcing of liquids practically as soon as the patient becomes conscious, and the administration of salt solution by the rectum and by infusion, has reduced the number of necessary catheterizations very markedly. Patients who have been subjected to a definite injury to the bladder are, however, catheterized more frequently, to prevent overdistention, and occasionally a retention catheter is left in the bladder for a few days. As far as possible, the immediate comfort of the patient is to be sought. Probably no one factor contributes more to this end than the employment of the Fowler position. For several years, in the care of these patients, the Gatch bed has been employed, by means of which they can occupy the sitting posture. The following advantages are to be gained by such a position:

1. Pelvic drainage is facilitated, with limitation of the infection to the pelvic peritoneum.

2. Nausea and vomiting are decreased.

3. Respirations are performed more easily, since the pressure from the distended abdominal viscera upon the diaphragm is greatly lessened.

4. The liability of postoperative pneu-

monia is greatly decreased by frequent modification of this posture.

### CONCLUSIONS

From a study of the cases treated at the Johns Hopkins Hospital, the following conclusions are drawn:

1. The extensive abdominal removal of all uterine cervical carcinomata is justified where there is any hope of complete excision.

2. An exploratory laparotomy is often necessary to determine whether or not a case is operable.

3. The preliminary catheterization of the ureters is a valuable aid, especially in fat patients, and does not necessarily increase the probability of fistula or secondary infection of the urinary tract.

4. Preliminary cauterization and disin-

fection of the primary growth is advisable in all cases.

5. A horizontal lipectomy in obese patients decreases the depth of the field of operation and shortens the time necessary for its completion.

6. All patients should be kept in the Fowler position for several days, unless this is otherwise contraindicated by symptoms of surgical shock.

7. By improvements in the technique of the operation, the primary mortality has been decreased from 28.5 per cent for the first seven years to 11.7 per cent for the last five years.

8. Aside from the discovery of the etiological factor of carcinoma of the cervix of the uterus and its successful elimination, the greatest hope lies in the early recognition and wide excision of the primary growth.

## INTRATRACHEAL ETHER ANÆSTHESIA<sup>1</sup>

1400 CASES FROM 22 SURGICAL CLINICS

By SAMUEL ROBINSON, M. D., CLIFTON SPRINGS, NEW YORK

*Surgeon to the Clifton Springs Sanitarium and Hospital, Dalton Scholar, Massachusetts General Hospital, Boston*

**I**NTRATRACHEAL anæsthesia, though a familiar term now to those who have employed this interesting method in surgical clinics, is nevertheless deserving of a brief description to those unfamiliar with it.

A small 22F tube is passed through the mouth, larynx, and trachea to the bifurcation of the bronchi. Ether vapor is then forced under constant moderate pressure through this tube, escaping around the tube. Intratracheal anæsthesia is not necessarily intratracheal insufflation, and it is a mistaken idea (though a common one) that intratracheal anæsthesia is of necessity attended by cessation of the respiratory movements. If the escape of vapor is diminished by using a larger tube and restricting the unoccupied space in the trachea, and if the entering fumes are accompanied by an increased volume of air, a condition of apnea may result. This is

permissible and sometimes unavoidable in thoracic operations with wide open pneumothorax. In intratracheal anæsthesia, however, it is preferable to preserve the respiratory movements, inasmuch as they serve as one of the best guides to the depth of the anæsthesia in this particular method.

The first account of animal experiments performed with the employment of this method, I published in 1898, thanks to the encouragement and suggestions of Professor Cannon of the Harvard Physiological Laboratory. The entire credit for developing the method along physiological lines in an admirable series of observations, and for introducing it to surgery, is due to Meltzer, Auer, Elsberg, and Quinby.

By the instigation of Dr. F. B. Harrington I was given the opportunity to construct an apparatus for use at the Massachusetts General Hospital, and through his courtesy

<sup>1</sup>Read before the Massachusetts Medical Society (Suffolk District), October 26, 1912.

and that of other members of the staff I have employed the method clinically in a series of 70 cases.

A time is always reached in the development of any new method when the experiences of a considerable number of operators must be accumulated, from which deductions may be drawn as to the safety, applicability, and usefulness of the method in question. Intratracheal anæsthesia has been employed clinically for four years. The experiences and deductions of any one administrator may well be open to question. For this reason I was reluctant to base my paper upon a series of 70 cases, lest I be credited with undue enthusiasm and with conclusions biased by a complete absence of unfavorable sequelæ following the use of an apparatus of my own construction. And I may say at this point that this paper is not a discussion of the comparative perfection of different forms of apparatus. It is true that all of the machines constructed for this purpose which have been thoroughly tested have produced, generally speaking, equally good results. Our interest is rather in the anæsthetic method itself than in the design of apparatus.

In order to accumulate sufficient data from which to draw definite conclusions I employed the following method. Writing to fifteen friends who are employing intratracheal anæsthesia, I enclosed twelve questions regarding their experiences. Each was requested to send the names of others in his vicinity employing intratracheal anæsthesia, and to these in turn the questions were likewise sent. The courtesy with which these thirty-five surgeons and anæsthetists have responded to my inquiries has been most gratifying. Twenty-two of the leading surgical clinics in the country are represented, in addition to a number of private clinics. Were you to know the sources from which this material is collected, you would agree with me that it may justly serve as a basis for rational deductions.

The series thus obtained includes 1402 cases in which intratracheal anæsthesia was employed. It should be borne in mind that a considerable proportion of the operations were of the type generally associated with

high mortality, including the more serious thoracic operations and surgical procedures about the head, neck, and pharynx. In this series of approximately 1400 cases, seven deaths occurred. In one of these the surgeon reports that he is inclined to credit the death (from broncho-pneumonia) to the intratracheal anæsthesia, inasmuch as at autopsy the infection appeared to have started from the bronchial mucosa. In a second case death occurred following emphysema, in which it is stated that a rupture of the lung occurred as a result of the tube being forced by an assistant who was holding it into one of the main bronchi. The apparatus was not fitted with a safety valve, and the tight fit of the tube in the bronchus prevented the escape of air around it, resulting in over-pressure unreleased. In a third case death occurred five hours after resection of the superior maxilla for malignant tumor. Death occurred in the fourth case on the third day after amputation of the tongue. A fifth death, on the eighth day, from pneumonia following laryngectomy for carcinoma, is recorded. The sixth fatal case, of pleuro-pneumonia, followed a thoracotomy for cancer of the œsophagus. Death followed pneumonia in a seventh case, after an operation for some septic process not described.

The one case of broncho-pneumonia in which the surgeon credits death to the method, and the case of death following rupture of the lung, should doubtless be accepted as induced by intratracheal anæsthesia. The so-called septic case is unexplained. The remaining four fatalities followed operations the severity of which is generally recognized.

In these 1400 cases four additional pneumonia cases are reported, with recovery. In all of these the recorders credit the infection to other causes than the method of anæsthesia. To claim that these pneumonias might also have occurred by other methods of anæsthesia would suggest the form of arguing not uncommon among those who are enthusiastic to prove the harmlessness of a procedure in which they may be vitally interested. I will therefore not attempt to influence you in your deductions as to the source of infection in six cases of post-operative pneumonia out of



1400 administrations of intratracheal anaesthesia.

In reply to the question regarding the occurrence of any complicating sequela to the anaesthesia other than pneumonia or emphysema, only one case was reported, that of aphonia of three days' duration following a difficult intubation with a woven catheter.

Among the 12 inquiries in the circular letter referred to, the questions of post-operative bronchitis, laryngitis, tracheitis, and pharyngitis were raised. Postoperative bronchitis was mentioned in one case only. Eighteen instances of tracheitis and pharyngitis are admitted in this series. With all due respect to the veracity of the several contributors, I am led from my own experience to believe that the low percentage of tracheal and pharyngeal irritation reported results from the fact that the irritation is generally so slight that the patient does not make the fact known. In my own series of 70 cases I made a point of questioning the patient as to this irritation, and not infrequently heard a "scraping" sensation described which the patient generally regarded as insignificant.

May we not conclude from these data that the intratracheal method employed both by skilled and unskilled anaesthetists and surgeons has been attended with less danger than many forms of anaesthesia, and with as few unfavorable sequelae as with the safest anaesthetic methods?

Furthermore the question arises as to whether, thanks to intratracheal ether, a considerable number of operations in this series did not result more successfully than had they been performed under other forms of anaesthesia. It would be interesting if possible to determine whether the mortality in tongue, jaw, and brain operations in this series had not perhaps been lower than other statistics would indicate, where the mask and cone anaesthesias had been employed. This leads me to mention the so-called advantages of intratracheal anaesthesia.

The intratracheal method provides a constant and uninterrupted supply of fresh air, to which is added a greater or less proportion of ether vapor. Cyanosis can be and is almost always avoided. Poor posture of the patient,

drooping of the jaw, falling back of the tongue, or nasal occlusion do not result in obstructed breathing. The entrance and escape of air, thanks to the presence of the tube in the glottis, are uninterrupted.

One would naturally suppose that the presence of a tube in the pharynx and trachea would result in hypersecretion of mucus. On the contrary the opposite is true. A patient anaesthetized by the cone method in preparation for the intubation generally enters the operating room with the pharynx filled with mucus. After the intratracheal tube has been introduced the pharynx is wiped out, and when once clean it remains so through the operation. The air escaping back around the tube tends further to dry the mucous membrane of the mouth and pharynx.

In view of our recent efforts to diminish postoperative shock by every possible means, it cannot be denied that complete oxygenation and lack of cyanosis are factors of importance in reducing shock. Even granting that continued cyanosis throughout an operation may not in itself influence the postoperative programme, the undue muscular exertion of a patient with obstructed air passages through a long operation unquestionably contributes to the expenditure of energy.

Postoperative pneumonia and pulmonary abscess are not uncommon sequelae to operations upon the tongue, jaw, and pharynx. Some of these infections are by direct inhalation of septic material. It is a notable fact that the ordinary accumulations of blood and mucus attending one of these operations are prevented from entering the glottis by the air escaping from the trachea. It is reasonable to assume that the avoidance of this inhalation is an added security against post-operative pulmonary complications.

Surgeons who have operated under the employment of this method will, I think, universally agree that the duration of operation is lessened. Operations about the head and larynx under other methods of etherizing are generally interrupted at frequent intervals by allowing the anaesthetist an opportunity to apply the cone in order to maintain anaesthesia. The resulting and constant tendency of the patient to be light in anaesthesia acts

as an impediment to progress, both by the rigidity of muscles and occasional vomiting. By the intratracheal method such interruptions are obviated. With the pharynx partially packed during mouth and jaw operations, retraction of tissues remains permanent, and hæmorrhage is better controlled. A considerable amount of time is thus saved, which is of unquestionable advantage to the patient. Meanwhile, thanks to lack of interruption, the improved hæmostasis and facilitated operative technique favor the final results.

In connection with hæmostasis, it should be mentioned here that, owing to the constant complete oxygenation and relief of respiratory obstruction, congestion of the tissues of the head and neck is reduced. Several operators, in reply to my inquiries, have agreed as to the value of this element in such operations; and those of us who have operated or witnessed operations in these regions under intratracheal anæsthesia have noted a cleaner operative field with less bleeding. Some surgeons have written of their approval of the method in goiter cases, stating that the lack of congestion following the easy breathing has been a contributing factor in the successful outcome of cases.

It may be said, therefore, that intratracheal anæsthesia is the one of choice in operations about the head and neck, including brain surgery. Some surgeons and anæsthetists are sufficiently enthusiastic to believe that this is a form of anæsthesia indicated in operations on other parts of the body. Where nitrous oxide and oxygen are indicated there would seem to be no occasion for intratracheal ether. On occasions where the drop ether method would ordinarily be selected, some of us would prefer to employ intratracheal ether. This is particularly true in the case of plethoric and obese patients where the respiratory passages are not infrequently obstructed during deep anæsthesia, such patients, we not uncommonly find, are to a greater or less degree cyanotic during long operations. Suprapubic prostatectomies and female pelvic operations performed in a marked Trendelenburg position are often attended with cyanosis, despite well-applied drop ether and the introduction of nasal tubes. Granting again

that cyanosis from the standpoint of anoci-association is a factor in post-operative shock, the intratracheal method is indicated in such operations.

As in spinal and intravenous anæsthesia, the question which we must decide is whether the history of intratracheal insufflation would contraindicate its use in all but that group of cases about the head and neck to which we have referred. I am of the opinion—and I shall listen with interest to the discussion regarding this opinion—that the reports from 1400 cases have been sufficiently satisfactory to indicate that intratracheal anæsthesia is as safe a method of ether anæsthesia as we have at our disposal, regardless of the seat of the operation. I have ceased to believe that one is not justified in inserting an intratracheal tube unless there is a particular indication for its use. This cannot justly be said of spinal anæsthesia, for instance, inasmuch as it may be argued that in a certain number of cases post-operative accidents have occurred which would doubtless have been obviated by ether anæsthesia. I am not satisfied that this is true of intratracheal anæsthesia, and I fail to find any argument against its general use provided the operator prefers to employ this method.

Those of us who have managed intratracheal anæsthesia during general surgical operations are universally impressed with the ideal conditions which exist. The patient appears to be under a hypnotic rather than an anæsthetic. Pulse and respiratory records during long operations show very slight oscillations from the normal. One sees none of the usual changes from quiet to stertorous breathing commonly accompanying the variations in the course of an ordinary ether anæsthesia; and inasmuch as the factors in administration all remain constant, the respiratory and circulatory functions of the patient appear to be equally unvarying. I believe that this constancy is an element in reducing post-operative shock.

The use of intratracheal and pharyngeal ether with the help of apparatus has in the past two years demonstrated that mechanically applied ether produces an entirely new form of anæsthesia, and it is a question whether

it is not showing us that we have hitherto underestimated the best anæsthetic properties of ether. The air supply remains constant, as it is driven from a rotary pump, and the amount of warmed ether vapor allowed to enter the mixture need not be altered after the first ten minutes until within fifteen minutes of the end of the operation. A light mixture steadily supplied keeps the patient constantly on the verge of "coming out", but at the same time completely relaxed. The anæsthesia in a way resembles what might be described as a continued primary anæsthesia. The length of the operation under a given mixture, arranged early in the operation as best suited to the patient in hand, does not apparently influence the depth of the anæsthesia, although the mixture remains constant throughout. In other words, the patient's immunity from the given dose of ether does not materially increase or diminish in the course of an hour's administration.

The total quantity of ether given is distinctly reduced, and I recall one case of my own series in which six ounces was sufficient for an operation lasting two hours and a quarter. In skillfully applied intratracheal anæsthesia the amount of ether is reduced to that required in ether anæsthesia by the rebreathing method; and the omission of the rebreathing element must be admitted to be of advantage, because of the lack of tendency to incomplete oxygenation.

It must be remembered that intratracheal anæsthesia as such was an accidental discovery in the course of experimental surgery of the thorax under intratracheal insufflation. It was discovered that, in the presence of wide openings in both sides of the thorax, oxygenation of the blood could be maintained by a constant supply of fresh air delivered through an intratracheal tube at the bifurcation of the trachea. Even with all accessory respiratory movements excluded by the administration of curare, the air exchange in the pulmonary alveoli was yet sufficient to prevent an excessive accumulation of carbon dioxide. In other words a new and simple method was discovered of preventing the dangers of pneumothorax during thoracic operations. Obviously it was necessary to add ether to

the insufflating air, and the anæsthesia thus produced was in itself so satisfactory that intratracheal anæsthesia has come to be employed as such in operations other than thoracic.

Experience with negative pressure, positive pressure, and insufflation has demonstrated that less than 5 per cent of routine chest operations require any mechanical aid to the respiratory functions. In this 5 per cent of chest cases insufflation is doubtless the preferable method. In the remaining 95 per cent, although opening the thorax is of no danger in itself, the intratracheal method of anæsthesia is unquestionably the ideal one. In my own experience of approximately 130 thoracic operations I have employed no form of anæsthesia comparable to this. Dr. Freeman Allen has frequently demonstrated to me the value of anæsthol, ether, and chloroform, interchangeable and skillfully employed. Despite the limited lung function generally present, as in a case of chronic empyema, Allen has by such selective anæsthesia prevented cyanosis. And yet intratracheal anæsthesia in these routine chest cases is even nearer ideal. The operation may place the patient in an apparently cramped position in order to render a portion of the thorax more accessible. The intratracheal apparatus may be so adjusted that a certain degree of insufflation results, improving the tidal air and preventing cyanosis and dyspnoea. If in the course of a routine thoracic operation it is discovered that the lung is less adherent than presupposed, and mechanical aid to respiration is indicated, the intratracheal tube, being already in place for anæsthetic purposes, is now adjusted to provide insufflation and the dangers of pneumothorax are rapidly overcome.

Another advantage is offered by the presence of the tube in cases of acute and subacute empyema. With a finger in the thoracotomy wound, the lung may at will be partially inflated, thus indicating whether it is yet mobile or is held by adhesions which should when possible be broken up to prevent the occurrence of chronic empyema. The introduction of a tracheal tube therefore is the indicated procedure in all thoracic cases,

whether of the 5 per cent of cases requiring insufflation or of the remaining 95 per cent in which anæsthesia alone is indicated.

Post-operative nausea and vomiting are admittedly factors in increasing the total destruction of brain cells attending any operation. In my circular letter the following question was included: How great, in your experience, is the extent of nausea and vomiting with intratracheal ether compared with that following ether anæsthesia by well applied drop methods? Answer, More, less; the same. One third of the writers answered that the degree of nausea and vomiting in intratracheal ether is the same as in the drop method. Two thirds replied that it is less than in the drop method. I may add that in my own experience the degree of nausea has been the same in both methods.

A word about certain features in the technique of the intubation. It is clear to me that all surgeons should become familiar with some form of technique of introducing an intratracheal tube: first, in order that they may use the method when intratracheal apparatus is at hand, but when there is no one familiar with intubation, second, in order that tracheotomy may become less common in certain emergencies. On one occasion I could not refrain from suggesting this to a throat surgeon. An œsophageal speculum, from prolonged usage, had pressed upon the trachea and caused serious cyanosis. With œsophagoscopes, bronchoscopes and Jackson specula at hand, he was on the point of doing tracheotomy. The intubation was performed skillfully and with immediate relief.

Some of those present here have been important contributors to the technique of intubation. There are three methods: the epiglottis may be raised with the left forefinger and a soft rubber tube guided to the glottis by a hollow metal introducer, as suggested by Cotton; an illumination speculum may be introduced, providing direct vision of the laryngeal opening through which the tube is passed; a braided tube or a rubber tube with stilette contained may be passed by sense of touch directly into the larynx.

The circulating letters brought responses to a question regarding the choice of these methods as follows: Soft rubber tubes of the Quinby type have been employed by approximately one half of the correspondents. The remainder have used a braided catheter or a stiletted rubber catheter. An equal number have utilized the hollow introducer and the direct vision methods.

Eynard has recently constructed for me an intratracheal catheter with two side eyes and a blind cup at the tip which receives the olive shaped end of a steel stilette. I have found it very satisfactory. Originally I used with like success the Cotton introducer and the Quinby tube. If, however, a stilette tube is equally efficient, I regard it as simpler and requiring less skill than the use of introducer or speculum. The general surgeon should be prepared at least to intubate with a stiletted catheter. The trained anæsthetist should be familiar also with the introducer and the Jackson speculum.

I present, therefore, the following conclusions for your discussion.

Intratracheal anæsthesia is a safe method; it is the anæsthesia of choice in operations about the head and neck and thorax. The mortality from such operations should be reduced by the use of intratracheal ether.

There is no contraindication at present to its employment in any surgical operation.

There are sufficient reasons for stating that operative shock is diminished and that the post-operative recovery is rendered less exhausting in all operations.

All recorded forms of apparatus and the several methods of intubation are successful and require but little technical skill for their employment.

NOTE — I have not mentioned the names of the surgeons and anæsthetists who contributed to the data upon which this paper is based, because in requesting them to answer the questions of the circular letter I indicated my intention to omit the names of clinics and of individuals. Nevertheless I would express my sincere gratitude to these men for their contributions to this series of cases and for their courtesy in responding so promptly to my inquiries.

## SEMINAL CALCULI SIMULATING NEPHROLITHIASIS

BY C. S. JAMES, M. D., AND J. W. SHUMAN, M. D., CENTERVILLE, IOWA

**T**HAT calculi of the seminal vesicles is a rare condition, is evidenced in a personal communication from Eugene Fuller, who has performed not less than two hundred and forty vesiculotomies. He states, "stone in the seminal vesicles *must* be very rare," and cites having met with but two cases in his experience, and one of those not definite.

Belfield (personal communication) states, "that organic concretions with lime salts, not exceeding buckshot in size, are not uncommon in the vesicles, and that he has encountered them in two cases of vesiculotomy." Furthermore, he states, "that concretions exceeding that size are quite an unusual occurrence." And again (*J Am M Ass*, lu, No 26), "the intimate relation between the juxta-vesical ureter and the seminal duct seems, therefore, responsible for considerable kidney and ureteral disease hitherto unexplored. Renal pain, 'lumbago' or 'nephralgia,' often occurs when the vesicle is distended."

Disque, of Pittsburgh (personal communication), reports having seen no cases with operative or post-mortem proof, but refers to cases of vesiculitis simulating to some extent renal calculi.

P. J. McHugh<sup>1</sup> makes reference to concretions or calculi sometimes occurring in the vesicles of the aged, the only symptom referable to them being colic, and thus infrequent. Reliquet first described this symptom, in 1879, as spermatic colic occurring at the time of an ejaculation. The pain, he states, is felt at the neck of the bladder, radiates upwards or down to the testicle, is sharp, and, reflexly, may produce nausea. The pain is due to the obstruction of the duct by a concretion of inspissated semen, and, as a result of the obstruction, the emission may be deficient or fail altogether, in which case, the colic may endure for a few minutes.

Casper<sup>2</sup> gives the best description, describing as a rare case seminal calculi growing as

large as a cherry stone so that they may completely occlude the ejaculatory duct. Their number may be numerous. He supposed their formation to be due to stagnation of secretion in the vesicles, occurring in advanced age, though it may take place at an early period in life when inflammatory processes have narrowed the lumen of the ejaculatory duct, so that there is an impediment to the outflow of semen.

The calculi give rise, not infrequently, to pain upon micturition and defecation. In a case where there is suspicion of seminal calculi, an attempt should be made to palpate the vesicles.

Keen<sup>3</sup> states that calculi of the seminal vesicles are usually only found post-mortem, often give rise to no symptoms, are as a rule soft and easily crushed between a sound in the bladder and finger in the rectum.

Tuholske<sup>4</sup> states that inflammatory diseases of the seminal vesicles are undoubtedly of frequent occurrence. Their close proximity and connection with the prostate makes posterior urethritis a prolific cause of vesiculitis which is most often mistaken for prostatitis, the chief symptoms being pain referred to the peritoneum, the groin, the lower rectum, and the lumbar region associated with defecation, and painful and frequent micturition.

Zeissel holds that "there is one symptom indicative of inflammation of the seminal vesicles, viz, erections which are almost constant and so painful as to constitute priapism. With the urine, blood and sometimes pus are evacuated, and seminal fluid escapes at stool." Examination per rectum reveals two elongated swellings by the side of the prostate running upward and outward at the base of the bladder. This inflammation may terminate in pus formation or peritonitis, or becoming chronic terminate in atrophy or permanent dilatation with the formation of concretions.

<sup>1</sup>Colorado Medicine, Dec 1911.<sup>2</sup>Casper's "Genito-Urinary Diseases."<sup>3</sup>Keen's "Surgery" 11.<sup>4</sup>International Text Book of Surgery 11.

Henry Morris<sup>1</sup> briefly mentions that tubercles, abscesses and stones in these organs may give rise to symptoms which resemble those of renal calculus.

That calculi in the seminal vesicles may present the definite clinical picture of renal stone may be satisfactorily explained by an exhaustive study of the nerve supply, which, summed up, may be briefly stated as follows. Irritation from seminal calculi can be transmitted to the respective kidney or lumbar region through, first, either the vesicle or prostatic filament of the inferior hypogastric or pelvic plexus to the hypogastric plexus, hence through the gangliated cord to the lumbar ganglia and either to the lumbar vertebrae and their ligaments (lumbago), or on through the aortic plexus, aortic-renal ganglia and renal plexus to the kidney substance (nephralgia), second, can be transmitted through the deferential plexus via short route to the gangliated cord, third the efferent filaments of the deferential plexus and the genitocrural nerve to the lumbar region, fourth, irritation may travel through the vas deferens filament of the pelvic sympathetic, the spermatic artery filament of the spermatic plexus and its numerous filaments to the renal or lumbar ganglia. Thus may be produced, by any one of the several routes, referred pain and tenderness.

A thorough investigation of this subject both by literature reference and personal communications, has failed to procure any operative or post-mortem proven cases to report other than the following

CASE 2639, Mr T E., aged 33, married four years, one child living and well. No children dead. First examined October 6, 1910, and found suffering from apparent right renal colic as evidenced by severe right-sided pain, rectus rigidity, frequent micturition, pain referred to penis and marked pain on palpation of the right kidney.

Urinary examination. Chemically negative, microscopically, few erythrocytes epithelium and phosphates. Case diagnosed as probable right renal calculi and yielded to usual hypo of morphin. Two days later, the patient passed by urethra what he described as a "slug," which was a blood-covered irregular calculus about the size of a grain of field corn.

Physical examination at the time revealed a tender right kidney on palpation. Labor or forced ex-

ercise excited pain in the right flank. Patient emphatically denied specific history.

Rectal examination evidenced a firm, non-painful prostate, the vesicles not palpated. Patient returned to his work, but complained of continued discomfort and pain in his right side all summer; when, on November 10, 1911, he again consulted and physical examination evidenced the same findings as before.

Blood examination, W B C., 7600; R B C., picture normal. Haemoglobin 80. blood pressure 110. Nephrotomy advised and accepted.

November 11, 1911, under ether anaesthesia, through a lumbar incision, the right kidney was sectioned and no stone present. Ureter patulous. Incision closed and the kidney drained by a sutured cigarette drain. Convalescence uneventful until removal of drain on seventh day, following which urine became bloody, patient later passing vermiform clots from the bladder. Urine stained out many gram negative diplococci intra and extra cellular and then it was, upon direct questioning, ascertained that the patient had suffered from gonorrhoeal infection fourteen years previous, with a right sided orchitis. Urine was thoroughly worked out per antiformin method, no tubercle bacillus found. General condition continued to grow worse due to the acute haemorrhagic anaemia and cystic tenesmus due to blood clots contained therein.

Blood examination. Haemoglobin 30, R B C., 3,200,000, W B C., 10,000. Poikilocytosis and a marked anisocytosis.

Death December 16, 1911, clinically from acute anaemia due to haemorrhage from the right kidney.

Autopsy December 16, 1911, by Dr J. W. Shuman, revealed the following findings. Right kidney's pelvis filled with blood clots, one extending well up toward the cortex and continuous with an old patulous suture hole. Cortex evidenced an unhealed opening continuous with the superficial drainage tract. Left kidney negative, ureters clear, bladder empty. Ureteral openings patulous. Mucous membrane of the cystic wall with the exception of pale appearance, shows no change. Prostates not enlarged and of normal consistency. Vasa deferens evidenced no change.

Seminal vesical walls hypertrophied. Four calculi removed from the right vesicle, situated near the fundus. dull white in color and faceted, ranging in size from that of a grain of popcorn to that of field corn. Seminal fluid stained out many gram negative diplococci.

Chemical analysis of calculi yielded phosphate and carbonate of lime 85 per cent, organic matter in which spermatozoa were found 15 per cent.

#### Pathological diagnosis

1. Pernicious anaemia secondary to haemorrhage.
2. Suppurative haemorrhagic nephritis of the right kidney.
3. Chronic seminal vesiculitis with calculi formation (dextra).
4. Chronic Neisserian infection.

<sup>1</sup>Surgical Diseases of Kidneys and Ureter, vol. II.

RESULTS OF THE RADICAL ABDOMINAL OPERATION FOR CANCER OF THE UTERINE CERVIX<sup>1</sup>

## REPORT OF 25 CASES

BY JOHN A. SAMPSON, M. D., ALBANY, NEW YORK

**M**Y early experience with this operation was while resident gynecologist at the Johns Hopkins Hospital, in the clinic of Dr. Howard A. Kelly, and the cases which I operated upon there through Dr. Kelly's courtesy belong to the records of his clinic and are not included in this report.

Since leaving Baltimore in the spring of 1905, I have operated upon twenty-five patients for cancer of the cervix, by the radical abdominal operation. Some of the pelvic lymph nodes were removed at twelve operations, and these were examined microscopically in all but one instance—unfortunately a node from one case, which in the gross apparently contained cancer, was lost. Metastases were found in one or more nodes in seven of the twelve cases (eight, if the one lost is counted as positive). We therefore know that at least seven of the twenty-five patients had metastases in one or more of the pelvic lymph nodes at the time of operation.

Five died as the result of the operation, and four of these were advanced cases in one (Fig. 1), the trigonum of the bladder and lower ends of both ureters (double ureter on one side) were resected, in another, a portion of the right external iliac vein was excised for the extension of cancer about it from a metastasis in an iliac lymph node (similar to the condition shown in Fig. 4), in another, several large cancerous lymph nodes, including a large lumbar node, were removed; in another, a portion of the bladder was excised. The fifth was less extensive than the above, but the patient was in feeble condition. One of the five patients died a few hours after the operation, and the other four died from four to seven days afterwards. All five apparently never completely rallied from the shock of the operation. In my experience, the opera-

tion in the favorable cases is attended with a very low primary mortality (in fact, I have not yet had a fatality in this group). The high primary mortality has occurred in the "border-line" and the advanced cases, where the growth is more extensive, requiring a more difficult operation, and the resistance of the patient is lower than in the early cases. This would emphasize the importance of not operating on the latter patients, were it not for the fact that some of them do survive the operation and may be relieved for a time, and even occasionally cured. With experience we will learn to discriminate what patients should not be operated upon. It is very hard for me to refuse to operate on an unfavorable case if I believe I can remove the entire growth, and it is also difficult to stop during the operation until I think I have. Only one instance of ureteral fistula occurred, from interference with the blood supply of the ureter, in the twenty patients surviving the operation, and this closed spontaneously. By leaving the ureter attached to the peritoneum above the base of the broad ligament and freeing the parametrial portion carefully from its sheath, the dangers of necrosis are slight.<sup>2</sup>

## THE END RESULTS (FIVE YEARS' LIMIT)

Eight of the twenty-five patients were operated upon over five years ago. Two of these died as the result of the operation, and two died later from recurrence. Four are clinically free from cancer at the present time, i. e., four of eight cases operated upon and of six surviving the operation.

*The Two Cases Dying from Recurrence.*

Both were young women, aged 30 and 32 years, who had never had children. Both

<sup>1</sup> For discussion of this phase of the subject see Johns Hopkins Hospital Bull., April, 1904, and J. Am. M. Assn., Sept. 10, 1904.

<sup>2</sup> Read before the American Gynecological Society, May 26, 1912.

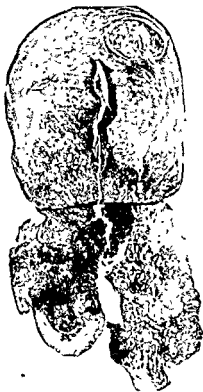


Fig 1. Advanced cancer of the cervix, inverting type arising within the cervix. Photograph of a stained (hematoxylin and eosin) median sagittal section of the uterus (natural size). Compare with Figs 2 and 3. The growth had invaded the bladder anteriorly, including the intramural portion of the right ureter and the parametrium about the left ureter, which was double, it had also invaded the body of the uterus. A small myoma is present in the fundus. The trigonum of the bladder and the lower ends of both ureters were resected. The patient died on the fourth day. The operation in this group of cases is attended with a high primary mortality and very little chance of a cure. Of nine cases in which I have resected one or both ureters and a portion of the bladder, four have died from the operation and the growth has recurred in all who survived, though two were clinically free from cancer for two years.

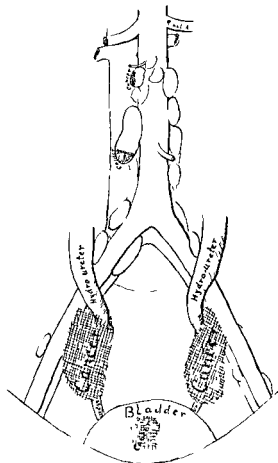


Fig 2. "Recurrence" found at autopsy in case shown in Fig 3 (½ natural size). The lymph nodes shown were all studied microscopically, and metastases were found in two abdominal lymph nodes as indicated. Both ureters were compressed by cancer just below where they cross the iliac vessels, from the extension of metastases in the iliac lymph nodes, the nodes most frequently infected in cancer of the cervix and the ones most readily removed at operation. A small recurrence was found in the field of operation between the bladder and the vagina, as indicated.

presented the same type of growth, namely, the inverting type arising from the portio vaginalis (Figs 2 and 3). Both appeared favorable before the operation: the uterus was freely movable, and the parametrium was apparently free. Pelvic lymph nodes were not removed in the first one. In the second, small parametrial lymph nodes were removed and found to contain cancer.<sup>1</sup> The iliac

nodes were not removed. The first one was apparently free from cancer for two years, and died from recurrence a year later. The second died within a year of the operation. The cause of death in each was the same, i. e., renal insufficiency from compression of the ureters by cancer. The symptoms were persistent nausea and vomiting with great loss in weight and strength. An autopsy was obtained in both cases. In the first, there was not any evidence of cancer found in the field of

<sup>1</sup> For discussion of this phase of the subject see previous article by author. The Participation of the Tumors Adjacent to the Uterus and of the Pelvic Lymphatics in Uterine Cancer. J. Am. M. Ass. Jan. 24, 1911.





Fig 3

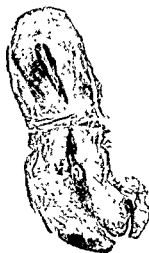


Fig 4



Fig 5

Fig 3 Apparent early cancer of the cervix, inverting type, arising from the portio vaginalis. Photograph of stained (hematoxylin and eosin) median sagittal section of the uterus (natural size). Compare with Fig 1. Patient died three years after operation from "recurrence," in this instance from metastases in pelvic lymph nodes not removed at operation. The parametrium, clinically and microscopically, was free from cancer, and the growth was apparently limited to the cervix. The operation in this group is attended with a low primary mortality (I have not lost a single case). Unfortunately a definite prognosis cannot be given, even when the laboratory findings are favorable.

Fig 4 Apparent early cancer of the cervix, inverting type, arising from the portio vaginalis. Photograph of stained (hematoxylin and eosin) median sagittal section of the uterus (natural size). Compare with Fig 1. Patient died within a year after the operation (see text and next illustration). The uterus was fixed in the pelvis by adherent tubes and ovaries, but the parametrium, clinically, was free from cancer. On the other hand, metastases were found in small parametrial lymph nodes. The laboratory findings gave an unfavorable prognosis.

Fig 5 Apparent "border line" cancer of the cervix, inverting type, arising from the portio vaginalis. Photograph of stained (hematoxylin and eosin) median sagittal section of the uterus (natural size). Patient clinically free from cancer, nearly seven years since the operation. By comparing with Fig 2 it can be seen that the primary growth is more extensive. While the parametrium felt thickened before the operation, the microscopical examination of this tissue failed to detect any direct extension of the growth from the cervical tissues or metastases in the small parametrial lymph nodes. A metastasis was found in one of the iliac lymph nodes. See text, Case No. 1 of those apparently cured. Some cases with metastases to the pelvic lymph nodes apparently may be cured. The primary mortality is greater in this group than in the early ones, but not quite as great as the "true border line" cases as shown in the next illustration.

operation, but the ureters were compressed by cancer, just below the place where they cross the iliac vessels, from the extension of metastases in the iliac lymph nodes. Metastases were also found in two of the abdominal lymph nodes. *The patient died from cancer in accessible iliac lymph nodes not removed at operation.* In the second, a similar condition was found, and in addition a small recurrence in the field of operation between the bladder and vagina (Fig. 4).

#### *The Four Cases Who Are Apparently Cured*

No 1. Para, aged 46, operated upon in August, 1905. The patient had been curetted a month before I saw her, and her condition had later been diagnosed as "inoperable" by another surgeon. Before operation the primary growth appeared extensive and the parametrium felt indurated. Some of the pelvic lymph nodes were removed and cancer was found in one. The type of growth was inverting, arising from the portio vaginalis (Fig 5), and locally more advanced than in the previous two who died from recurrence. In spite of a previous curettage, an extensive primary growth with a

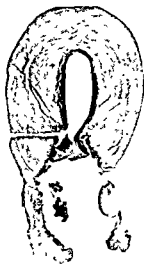


Fig 6



Fig 7



Fig 8

Fig 6 "Border line" cancer of the cervix, inverting type, arising within the cervix. Photograph of a stained (haematoxylin and eosin) median sagittal section of the uterus (natural size). Compare with Figs 1 and 8. Patient clinically free from cancer nearly seven years since the operation. Before operation the cervical canal was found to have been converted into a thin shell lined with necrotic cancerous tissue, and its movements were restricted. The cervix was torn in removing the uterus and the field of operation infected with fragments of cancer. See text, Case No. 2 of those apparently cured. Microscopically, cancer was not detected in the parametrium laterally but had extended through the anterior wall of the cervix and had invaded the posterior wall of the bladder a portion of which was removed with the cervix. My primary mortality in this group of cases has been about 20 per cent, and yet some of these may be cured.

Fig 7 "Border line" cancer of the cervix, inverting type, arising within the cervix. Photograph of a stained (haematoxylin and eosin) median sagittal section of the uterus (natural size). Compare with Figs 1 and 8. Patient clinically free from cancer, nearly six years since the operation. The growth appeared extensive before the operation and microscopically it had extended beyond the cervix and invaded the parametrium slightly on each side. A small myoma is situated in the anterior uterine wall. See text, Case No. 3 of those apparently cured.

Fig 8 Early cancer of the cervix, inverting type, arising within the cervix. Photograph of stained (haematoxylin and eosin) median sagittal section of the uterus (natural size). Compare with Fig 1. Patient clinically free from cancer over five years since the operation. A polyp is situated in the fundus and a small myoma in the anterior uterine wall.

diagnosis of "inoperability," and metastasis found in an iliac lymph node, the patient is clinically free from cancer at the present time, i. e., nearly seven years since the operation.

No. 2 Nullipara aged 40, also operated upon in 1905. Before operation the primary growth appeared extensive, the cervix having been converted into a thin shell and its movements were restricted. At operation the cervix was found to be adherent to the bladder, and in attempting to free the bladder the cervix was torn, the field of operation infected with the necrotic cancerous material, and the specimen removed in fragments. The case was considered unfavorable, and no attempt was made to remove the pelvic lymphatics. The type of growth was inverting, arising within the cervix (Fig 6). In spite of an extensive primary growth, its removal in fragments, and the infection of the field of operation with cancer, her physician, Dr C. G. McMullen of Schenectady, informs me that she is apparently cured.

No. 3 Para, aged 43, operated upon in 1906. Before operation the primary growth appeared extensive, though confined to the cervix. Pelvic lymph nodes were not removed. The type of growth was inverting, apparently arising just within the cervical canal (Fig 7).

No. 4 Para, aged 53. Both tubes and ovaries had been removed five years before for pelvic inflammatory conditions, operated upon by me in April, 1907. Before operation the growth was apparently restricted to the cervix, the uterus was fixed (due to adhesions), causing a diagnosis of "inoperability" to be made by the surgeon who had first operated upon her. Pelvic lymph nodes were not removed. The type of growth was inverting, arising within the cervix (Fig 8).

The two patients dying from recurrence were both young women, with an average age of 31 years, who had never had children. The type of growth was inverting, arising

from the portio vaginalis, and the cases appeared favorable before the operation; and both died from extension of metastasis in accessible iliac lymph nodes (a small recurrence in field of operation was present in one). The four apparently free from cancer five years or more since the operation (two nearly 7 years) were older women, average age 45+ years; three had borne children, the other had not. The type of growth in three was inverting, arising within the cervix, and one inverting, arising from the portio vaginalis. Three of the four appeared unfavorable before the operation. In only one were the accessible pelvic lymph nodes removed, and cancer was found in one of these.

These cases are too few in number from which to draw any definite conclusion, but they show that what appear to be unfavorable cases may sometimes be cured, and that it is not safe to give a favorable prognosis in an apparently early case. With further experience, we will learn on what to base our prognosis, such as the origin of the growth—whether from the portio vaginalis or within the cervix, its type inverting or evertting, its histological structure, the age of patient whether para or nullipara, etc.

I have had the opportunity to obtain autopsies on five patients dying from recurrence (including the two just reported). In three, the immediate cause of death arose from the compression of the ureters by cancer extending from metastases in accessible iliac lymph nodes. In the fourth, there was an extensive local recurrence in the field of operation from cancer not removed at operation (an advanced case). In the fifth, there was an extensive local recurrence filling the pelvis with metastases to the lungs, heart, one kidney, and skin.

Based on my own experience, I believe that metastases are present in from one third to one half of the operable cases, and that while lymph nodes which are not readily accessible may be involved as well as accessible ones, the latter are the ones which are most frequently involved, and sometimes the only ones, and I refer especially to the iliac lymph nodes near the origin of the internal iliac vessels. I therefore believe that these nodes should be removed when the condition of the patient will permit, and especially in the early cases where the operative technique is easy and the resistance of the patient is unusually good.

## SKIAGRAPHIC DEMONSTRATION OF VESICAL TUMORS

By HOWARD A. KELLY, M.D. and ROBERT M. LEWIS, M.D., BALTIMORE

As a rule tumors of the bladder offer as little resistance to the passage of the X-rays as the surrounding healthy normal tissues; consequently, no matter how large the tumor, a skiagram made of the unprepared bladder with its contained growth will show neither bladder nor tumor. If the bladder is filled with air, either by catheter with an attached hand syringe or by a catheter in the knee-breast posture, and a radiogram is then taken, the resulting picture will show perfectly the outline of the bladder, but as the tumor offers approximately the same resistance to the X-rays as the surrounding tissues, it will not register on the plate.

Were we ignorant of this how puzzling it might be, first, cystoscopically to demonstrate the tumor, and then to take an X-ray picture and to show a normal bladder outline with no growth visible. Under such circumstances one would almost be tempted to make a diagnosis of "phantom tumor of the bladder."

It is then evident that some foreign medium must be introduced into the bladder to throw the tumor into relief if it is to be seen at all.

In the first case we show here this has actually been done. The condition—a papilloma of the bladder—was recognized cystoscopically. A suspension was then made of bismuth subnitrate with gum tragacanth and

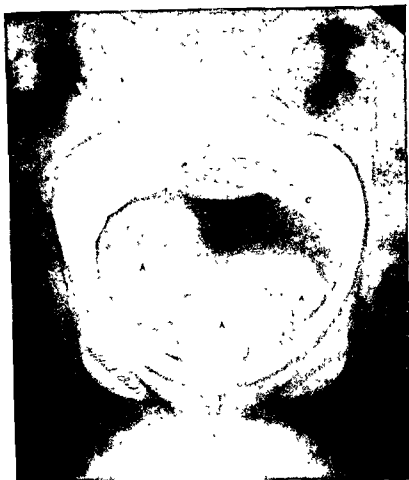


Fig. 1

water. This was shaken up and rapidly run into the bladder. Fortunately, as later shown, the suspension, which is never perfect, was in this instance a poor one, and the bismuth salt rapidly precipitated. The radiogram was then taken at once.

Looking now at the illustration we discern three well-defined areas, A, B, and C. The area A represents a conglomerate of large growths, showing beautifully the papillomatous nature by the cauliflower like outlines. The bismuth has evidently settled apart from the mixture, filtering into the crevices and interstices in the surface of the growths, bringing out their characteristic details with astonishing clarity. The tumor mass is

separable into three divisions, and more than half fills the bladder in its present state of distention. Note especially that, good as the picture is, a very important detail the size and situation of the pedicle, is left undetermined. About the tumor is seen a dark zone (B), which evidently represents the injected bismuth suspension. Above this, the gray area (C) is probably the result of the presence of a small amount of urine, water, or air which has accidentally leaked in. A little bismuth has adhered to the apex of the bladder and causes the dark shadow seen there.

In the second case, the diagnosis of papilloma of the bladder was again established by



Fig. 2

cystoscopy. Instead of using bismuth suspension in this case, the bladder was injected with 40 cc. of a 5 per cent strength silver iodide emulsion. About half the amount injected was then voided. In doing this the patient experienced considerable difficulty as the tumor directly overhung the internal urethral orifice and, dropping upon it, acted as a ball valve and checked the flow. Part of the silver solution being expelled with the patient still in the dorsal position, the bladder was next distended with air, using a syringe bulb attached to the catheter for that purpose. Here, again, some little difficulty was encountered, as the air tended to leak out around the catheter. By holding the parts together,

however, most of the air was retained. The plate was immediately exposed.

The second radiogram also shows three zones, even more distinctly defined than in the previous picture. The large tumor (A) is sharply defined, the growth being, of course, slightly exaggerated. It must be remembered that the size of the shadows in all radiograms depends on two factors, the size of the object taken and the relative positions of plate, object, and X-ray tube. We can, by taking stereoscopic radiograms following Dr. Manges' method of pelvic measurement, determine with accuracy the size of the tumor.

Here we call attention to the fact that the second picture does not give the irregular and

rough outline of the body of the papilloma so well as the first. The reason for this will be discussed later. Notice that a large amount of encircling healthy bladder wall is shown from the X-ray taken without distention and the media used, or from the cystoscopic picture, in the case of so large a tumor one naturally concludes that the greater part of the bladder wall is involved by the growth. Here though the tumor is large, one can almost surely say that the only part of the bladder wall involved is that part to which the pedicle is seen attached. Plainly no growths are present outside the area covered by the tumor. We may pretty safely conclude, too, that no other growths of any considerable size springing from separate bases are concealed by the massive growth shown for were this the case we would almost certainly be able to see at least a small part of the secondary growth jutting out from behind the margin of the large tumor.

Although the picture under consideration does not show the roughness of the surface characteristic of papilloma, there is a most important point not brought out in Plate I, but extremely well shown in the second i.e., the pedicle (P) of the growth, which is here well defined and comparatively small, being about  $1\frac{1}{2}$  cm in diameter. Its size and situation were later proved by a direct method of measurement. A small hooked instrument was passed through the open cystoscope until it touched the posterior vesical wall. The point on this corresponding with the external orifice was carefully noted. The instrument was then withdrawn until the hook pressed against the surface of the pedicle farthest from the urethra. The handle of the instrument was then measured from the point previously determined to the point now found opposite the shoulder of the cystoscope, and this measurement was, of course, the distance of the pedicle from the posterior bladder wall. Making a note of the last point determined on the handle of the instrument, the hook was disengaged from the pedicle, withdrawn slightly, and then pressed against its anterior surface. The distance between the point on the handle previously noted and the point found opposite the outlet of the cystoscope was  $1\frac{1}{2}$

cm, the measurement of the diameter of the pedicle.

The dark shadow B surrounding the tumor represents the silver iodide emulsion left in the bladder. The light zone about this in turn is the injected air distending the bladder. In the second case considered, the clear demonstration of the pedicle is most valuable, and is probably due to the fact that a solution of very high specific gravity was employed. This floated the tumor away from the bladder wall and surrounded it everywhere except at the site of attachment.

In this case it was remarked that the characteristic irregular outline of the papilloma was not demonstrated, this undoubtedly resulting from the thickness and viscosity of the silver iodide solution, which prevented its penetration into the interstices in the surface of the growth. It must be added that direct inspection showed the surface of this tumor not to be as irregular as in the other instance, this fact alone, however, would not account for the lack of detail shown. This case (No 2) is at present under treatment with the high frequency current. In spite of the large size of the growth three treatments have almost eradicated it.

To bring out both surface detail and pedicle in our next case, we propose to combine the methods just described, first, injecting into the bladder a bismuth emulsion, or better perhaps, a simple suspension of bismuth subnitrate in water without tragacanth, allowing this to precipitate and coat the tumor, then letting the patient void as much of the solution as possible. The next step will include the injection of 30 cc of a 5 per cent emulsion of silver iodide, which should float up the tumor and surround the pedicle; and finally, inflation of the bladder with air, as described in Case 2.

A point not previously alluded to is the obvious bearing of the posture of the patient on the position of the tumor. Evidently, if the pedicle is attached to one side of the bladder, leaning in the opposite direction will cause the growth to drop away from the vesical wall to which it is attached, increasing the likelihood of its being surrounded by the fluid injected.

Unfortunately, irritation of the bladder is the rule, especially in the case of vesical tumors of large size. Much discomfort and distress to the patient may be avoided by instilling a 4 per cent solution of novocaine and allowing it to remain in the bladder for ten minutes before beginning the necessary manipulations.

The foregoing description might lead to the supposition that much time must necessarily be consumed in performing the steps recom-

mended. This, however, is not the case, a very few minutes sufficing for the entire procedure.

We would add in conclusion that we are now trying out various preparations of silver iodide for X-ray purposes in vesical, ureteral, and kidney work. We have an unusually good radiogram of the renal pelvis and ureter injected with 5 per cent silver iodide emulsion in a case of ureteral calculus.

The excellent radiograms were taken by H. H. Hart.

## GENERAL PLASTIC PERITONITIS

WITH REPORT OF A CASE

BY WILLIAM R. CUBBINS, M. D., AND W. J. MARVEL, M. D., CHICAGO

**H**ENRY Z., aged 37, male married, occupation saloonkeeper. Referred by Dr W. J. Marvel. Diagnosis, obstruction of bowel, probably sigmoid. Family history good, no tuberculosis.

Previous illness. Denied in toto all possibility of ever having been ill previously, either with pains in the belly or anywhere else. Claims that he does not drink except very moderately. Venereal history denied, but no Wassermann reaction was made.

Seven weeks ago he began to have a colicky pain in the left side of the abdomen, which radiated to the right side and was frequently severe around the navel. This pain was accompanied by nausea and vomiting, but no chills, temperature or tenderness. After a short while (the exact period of time is in doubt) he began to notice the swelling of the abdomen, but did not remember that there was any special change or any special distention of one spot.

Appetite has been fair when he has not been in one of the attacks. Has not noticed any particular food or action that would be likely to bring on an attack. Bowels have been regular and no blood or other abnormality noticed.

Urine normal in frequency and general character. No pain or difficulty at any time. Chemical and microscopic examinations negative.

Physical examination. Thin and rather sallow looking, skin dry and loose, hair dry and thin, chest normal to our examination, marked abdominal distention. Cardiac area displaced upward but heart regular in rate and rhythm. Sounds normal.

The distended abdomen presented a V shaped mass, which extended from the left hypochondrium downward and inward to the pubis and then upward to a point between the umbilicus and the anterior superior spine of the ilium. The walls were so tense

that only the fact that there was a vastly distended bowel present could be made out — the angulation, however, being distinct. It was slightly tender, but nothing marked. There was no sign of fluid and there was no edema of the scrotum or extremities.

At this time he had been vomiting continuously for nearly twenty-four hours and the vomitus had a dark color with a disagreeable odor, which, however, was not fecal. No obstruction to the rectum could be made out with examining finger and no gas would pass with enema.

Without delay the abdomen was opened, the incision being made to the left of the median line and a large, sausage-shaped tumor was found which began under the left hypochondrium at the duodeno-jejunal angle and passed outwards, then downwards, forwards and inwards to the pubis and up after an acute angulation at lowest point to a point midway between the anterior superior spine of ilium and navel, where it disappeared into the posterior abdominal wall.

There was no fluid, no small bowels, no colon nor omentum visible. The large blood-vessels on the surface of the spinal column were distinct cephalad to the tumor mass. The upper portion of the abdomen was cut off from this area by a membrane, which extended from the posterior to the anterior wall. This membrane, which was similar to that covering the other parts of the cavity exposed, was clear and of a hyaloid character,

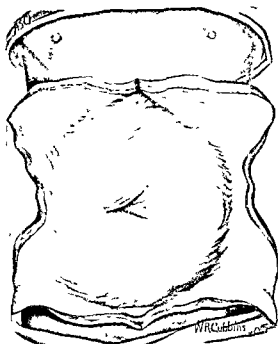


Fig 1

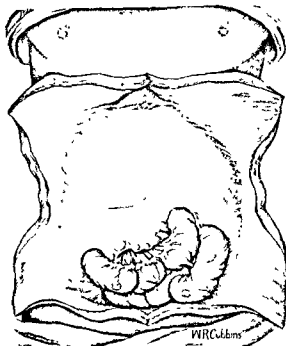


Fig 2

and, when opened, proved to be the transverse colon and the omentum, which was firmly adherent to the anterior abdominal wall.

We then began to try and separate this membrane at the lower portion of the tumor mass and found that it would peel off in large flakes and leave the small intestine and one inch of mesentery free and of normal size. To free about six inches of this membrane would loosen up from two to four feet of small bowel, which was laid together in a manner similar to the plaits of a dress (Fig. 2), but, of course, in a rather irregular formation. This membrane was not so firmly adherent to the intestine as it was to the mesentery, except on the distal side, where the bowel had been the most distended. At these points (Fig. 2) of contact there would be bleeding from the bowel surface and there would also be bleeding from the mesenteric surface, if this membrane was detached from it. It is very essential to emphasize the firm attachment of this membrane to the markedly thickened mesentery, in order to prevent some from thinking it might be a retroperitoneal hernia.

I wish to emphasize the fact that fully four-fifths of the uncovered bowel was covered by almost normal peritoneum, being a little granular, except from the points of pressure, where it was ragged and bled. I did not attempt a complete removal of the membrane from the mesentery, as it was not necessary and would only increase an already tedious operation. The liberation of a spot in the lower ileum finally removed the obstruction and the gas, etc., passed into the large bowel.

By this time we had the small bowel freed from the membrane down beyond the ruffling of the mesentery and turned our attention to the colon and sigmoid.

This large bowel was in normal position behind a tense membrane, continuous with the membrane opened above in the transverse mesocolon, which extended from the front of the spinal column to the sides of the abdomen in such a manner as to obliterate the normal depression occurring in this area (Fig. 1). However, the membrane here was much more firmly attached to the peritoneum, and it could not be torn without opening into the retroperitoneal fat or onto



the surface of the colon, cæcum, or sigmoid, which were firmly pressed into the fossa renalis by this membrane.

Another point of value here is to say that here the peritoneum was not puckered or folded, but tense, like the membrane covering it. This in distinction to the membrane covering the small bowel, which might be accounted for by the fact that the small bowel was more active and kept itself somewhat free.

No attempt was made to open farther into the upper part of the abdominal cavity, as we felt that quite enough to obtain at least temporary relief had been done and later, if necessary, more could be freed.

The man made a slow but fairly good recovery and seemed to be going towards permanent health when he was taken with tuberculosis of the lungs and died, about nine months after the operation, and about two months after his pulmonary phthisis was noticed. Much to our disappointment, no post-mortem examination was permitted.

In the hurry of the operation and getting the man to bed, the small specimens of membrane were lost and consequently no microscopic examinations were made, but I felt that the case was worthy of mention, in spite of the fact that it leaves a cloudy etiology and an imperfect diagnosis.

When one begins the study of a case of this type, he is immediately struck with the paucity of literature that bears directly upon the case. Probably the best article is that of Albert G. Nicholls, of Montreal, who has described cases on the same order in an article called "Some Rare Forms of Chronic Peritonitis." He makes a classification after this manner

#### Chronic Hypertrophic Peritonitis

##### Sporadic

##### Diffuse.

Simple Tubercular. Simple T.B.C. Carcinoma.

Under this classification he brings such medical novelties as Curschman's Zuckergussleber, and also all the small local areas which are of appreciable thickness, and present the clear hyaloid appearance with which we are familiar as they occur upon the surface of the liver and spleen. However, all of the

insidious diffuse cases which he describes have been associated with ascites, which was absent in this case. The cases cited by him from the German are subsequent to injuries and all complicated with ascites.

This brings the discussion into a wider field, that is, Does the ascites of a chronic heart or liver lesion excite the peritonitis that occurs in those cases, or does the peritonitis cause the ascites? This must be left to others, with the fact presented here, that we have a diffuse hyaloid membrane, covering the entire peritoneum, yet with only a normal amount of fluid.

Here it is necessary for us to mention that class of cases which is spoken of as a polyserositis, and which is beautifully described by A. O. J. Kelly. In these we have a multiple involvement of the serous membrane with adhesive pericarditis, pleuritis, and peritonitis, the origin of which change arises in about one-half the cases in the upper abdomen, in about one-half of the remainder in the pleura and pericardium, which leaves one-fourth, the origin of which is unknown. In these cases the peritonitis, as a rule, is most marked in the upper part of the abdomen, where one-half the lesions begin. This also brings into the discussion the so-called pericarditis pseudo-cirrrosis of Pick, which is nearly always associated with ascites.

As to what part tuberculosis may play in this condition, there is great doubt, but it has been shown that with a bacillus of low virulence the tubercular lesion may be constructive more than destructive, and while the caseous nodules may be absent, there will be a hyaloid membrane relatively avascular that resembles the one I have described. The question as to whether the mild attack of the bovine tubercle bacillus would be the most likely to cause this type of peritonitis will need also to be discussed.

The next point in relation to this case and tuberculosis is whether it would be possible to have a tubercular membrane of the extent this was without its being firmly attached to the bowel at all points.

This hyaloid type of peritonitis may also complicate a carcinoma which has perforated the walls of one of the hollow viscera. This

combination of inflammation and neoplasia Nicholls says would exactly reproduce the picture of a hyperplastic peritonitis. The development of a membrane over any foreign body in the peritoneal cavity has been investigated by a great many and at present we are told that the fibrin is thrown over the mass and appears in parallel fibers; that this fibrin later becomes fibrous tissue and covered with endothelial cells. It is also said that the fibrin deposit nearest related to the endothelial covering is the first to assume a fibrous character. It has been shown by some investigators that when the streptococcus or colon bacillus is present, we have a granular fibrin which does not tend to form permanent adhesions, while, should the fibrin exudate be caused by a pneumococcus or gonococcus, it is striated and organizes into permanent adhesions. This I do not believe will be justified by later investigators. However, it serves to suggest to us that perhaps this man

may have suffered an infection with the colon bacillus, causing a diffuse infection and later the organization of this hyaloid membrane.

But to return to the fact that this man died of a pulmonary tuberculosis makes us wonder about the possibility of his having had a tubercular polyserositis of a mild type, which, after the weakening strain of an obstructed bowel and subsequent operation, was enabled to become more virulent and obtain a pulmonary footing, in this way closing the picture

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## THE RELATION BETWEEN SARCOMA AND MYOMA OF THE UTERUS AND ITS BEARING ON X-RAY THERAPY OF UTERINE MYOMATA<sup>1</sup>

By JAMES RAGLAND MILLER, M D

SINCE the advent of the X-ray treatment of myoma of the uterus, the clinical importance of uterus sarcoma has greatly increased. In the early days of the operative treatment of myoma, when enucleation, castration, and other conservative procedures were carried out, the question of the frequency of sarcoma accompanying myoma was much discussed by Fehling, von Ott, and others. At that time, Winter came to the conclusion that operation was not indicated through fear of sarcoma, for the primary operative mortality was much over 6 per cent, and he could claim only 4 per cent occurrence for sarcoma.

The discussion of this subject was quiescent during the time when the total extirpation of the uterus was the operation of choice in

treating nearly all myomata. At present, however, the opponents of the X-ray therapy particularly have revived the question, and paint very black pictures of the heavy responsibility that the X-ray therapeutists take upon themselves, the most extreme opponents go so far as to warn against the X-ray therapy, because a sarcoma might thereby be overlooked. These authors, von Herff, Walddhardt, and others, probably reason along the following lines:

Every woman with sarcoma of the uterus who is subjected to the X-ray treatment is lost; every woman, or at least most of these women, if treated by operation, can be saved.

The X-ray therapeutist can, however, bring up the following points for consideration:

<sup>1</sup> From the Universitäts Frauenklinik Freiburg, Germany, Prof Krönig Director

Table I. Occurrence of Sarcoma

Author	Myoma	Sarcoma	Per cent
Bosso	105	6	5.7
Fehling	400	8	1.8
Hofmeier	578	11	1.9
Winter	753	27	3.5
Walthardt	95	4	4.1
v. Guhl	883	2	2.3
Gesler	288	8	2.8
Hauher	138	3	2.2
Barnomo	39	1	3.3
Warnek	120	3	2.5
Pinard	68	1	4.2
Haultain	120	1	1.7
Henkel	146	1	1.3
Snegureff	83	5	6
Evelt	139	1	1.1
Nobel (collected) <sup>1</sup>	1094	31	1.5
Torkel	313	10	3.2
Meslay and Hyenne	41	2	5
Martin	205	6	3
Essen-Möller	105	0	0
Kelly and Culle	1400	17	1.2
Schottländer	355	11	3.3
Fleischmann	385	7	1.8
Frankl	216	5	1.4
Bumm	300	4	2
Hertel	468	13	2.8
Total	9750	102 (average) 1.06	
Collected statistics by			
Lewis	1518	22	1.4
Olshausen	6470	77	1.2

<sup>1</sup> 280 cases of McDonald with 3 sarcomata not included (antony cases)

<sup>2</sup> Contains 1000 cases of Pfannenstiel, evidently only sarcomatous degeneration

**First** Is sarcoma so common in connection with myoma as the opponents of the X-ray therapy would have one believe?

**Second** Is sarcoma really so difficult to diagnose?

**Third.** Are sarcoma patients really cured under the operative treatment?

**Fourth** Is it not also possible to cure, or at least to check the growth of sarcoma by means of X-rays?

It is not yet possible to give a final answer to this last question, because the cases treated with X-rays are by no means so numerous as those treated by operation, and the period of observation is still too short. Some of the questions can, however, be answered by means of a study of the literature and of the experience up to the present time with the operative treatment. Such a review of the literature has not yet been made. I have undertaken to do it in the following pages, and at the close I shall report the experience of the Freiburg Frauenklinik in relation to this subject.

Table II. Radical Myomectomies

Operator	Number of Cases	Deaths
Sarwey (collected)	2450	111
Biermer (Torkel)	180	13
Kleinhaus (Garkisch)	202	16
Guicciardi	367	20
Czempin	36	0
Franz	235	2
Essen-Möller	205	6
Fritsch (Grell)	272	43
v. Franque	158	6
Kiparsky	960	41
Martin	134	10
Scharlieb	100	2
Schottelius	127	5
Pawlik (Pitha)	148	7
Tauffer	364	21
Thorn	175	3
Walthardt	98	1
Jordan	76	2
Karczewsky	48	3
Winckel	44	6
Döderlein	67	4
Flatau	100	0
	6646	324 = 4.87%
	1932	99 = 5.1%

Döderlein Krönig (1st Edition)

The questions which I shall try to answer by means of the study of the literature are as follows:

1. What percentage of myomata are found to be sarcomatous?

2. What is the primary operative mortality of the radical myoma operation?

3. What is the primary operative mortality in sarcoma cases? What is the percentage cured?

4. What per cent of sarcomata can be diagnosed? That is, if they all come to us in consultation, what per cent should we not treat with X-rays?

To answer the first question, I have taken from the literature figures which present reports of continuous series of cases among which the search for sarcoma was made. The results can be seen in Table I.

The geographical distribution of sarcoma may be of some importance, but I believe the variability, and particularly the extreme difficulty of the microscopic diagnosis in the individual cases, to be the chief causes for the great differences in figures. Winter claims to have found 4 per cent sarcoma among 700 myoma cases. Pfannenstiel, on the other hand, could not find a single case of sarcomatous degeneration among 1000 cases. According to the figures given in the table, the first question may be answered with 2 per cent.

2. To answer this question I have collected the figures given in the literature which rep-

TABLE III

Author	Sarcoma	Post-oper	Recurrence	Total	Per cent	Over one year free from recurrence	Remarks
v Franque, München. med. Wehnschr., vol. 98, No 41	16	?	?	?	?	2	3 of the 7 doubtful sarcoma
Vent, Handb u	42	5	?	5	12	7	
Weil, Handb, p 55	57		?	?	?	14 <sup>2</sup>	
Stroganowa, Monatschr., vol 18, p 360	12	0	?	?	?	2	Vag Hysterectomy Supravag Amp Mucosa sarcoma Interstitial sarcoma
	66	5	20	25	38		
	23	5	7	12	48	2	
Pignaud, Rev de Gyn, 1905, p. 850	36	0	13	13	38	24	
	53	0	25	25	48	27	
Gessner (Winter), Ztschr f Geburtsh. u Gynäk., vol 57, p 29	4	0	3	3	75	1	Excision Supravag Amp Vag Tot Exst Tot Ex Exploratory Lap
Klein, Monatschr., vol 7, p 116	36	3	13	16	44	?	
Meineke	8		?	?	?	6	
Torkel, Monatschr., vol 29, p 346	?	1	?	1	14	?	
Rogione, Diss. Zürich, 76	50	6	32	38	76	3	
	2	0	0	0	0	2	
	2	1	0	1	50	1	
Feider, Diss Bern, 1907	5	0	3	3	60	2	
	3	1	1	2	66	1	
	3	0	3	3	100	0	
Total Feider	15	2	7	9	60	6	
Our cases	5	1	0	1	20	2	

<sup>1</sup> 1 of the 13 2 years later dead from recurrence<sup>2</sup> 4 of the 25 4 years later dead from recurrence<sup>\*</sup> Discharged uncured

resent radical operations such as are usually done in myoma cases as shown in Table II

These figures must, of course, be more closely scrutinized. Olshausen, for example, operated on about 15 per cent of his myoma cases, whereas Noble wanted to operate on every case<sup>1</sup>. It is self-evident that the stricter the indication for operation the greater will be the mortality, other things being equal. Good statistics may also be obtained by refusing to operate on serious cases.

Considering the figures here given, the primary mortality of the radical myoma operation seems still to be between 4 and 5 per cent.

3. What are the primary and permanent results of this same radical operation when done on cases of sarcoma of the uterus? Table III

Among the 180 cases which I chose from the literature to answer the fourth question, and which can be seen in full in the current number of *Strahlen-therapie*, 23, or 12.7 per cent, were reported free from recurrence of sarcoma after a period of 12 months or more. Of these 180 cases, 81 died, some following the operation and some from recurrence or metastasis; 76 cases were not followed over 12

months. If these 76 cases be excluded, the total mortality from operation and failure to cure would reach the high figure 79 per cent. Of the 180 cases, 74 were sarcomata of the uterine wall, with a mortality of 47.3 per cent, 40 were sarcomata of the mucosa, with a mortality of 42.5 per cent, and 66 cases, in which the kind of sarcoma was not designated, had a mortality of 40.9 per cent.

From a consideration of these facts it seems clear that even with the use of the operative treatment a certain cure of more than 25 per cent at the most cannot be assured.

4. Little if any progress has been made in the diagnosis of sarcoma of the uterus. All authors agree that a diagnosis is almost impossible in the early stages, when the usual signs of malignancy fail. A microscopical examination should be made upon the least suspicion. For the X-ray therapist, however, the question of diagnosis can be put concretely as follows: What per cent of the sarcoma cases described in the literature would we get through failure of diagnosis subject to the X-rays instead of the operative treatment, had they all come to us in consultation?

To answer this question I have read over nearly all the reported cases of sarcoma of the

<sup>1</sup> Essen Müller operated on 51.3 per cent of 300 cases, Winter, on 45.8 per cent of 393 cases, Olshausen, on 16.1 per cent of 927 cases and Holmeier, on 60.7 per cent of 578 cases.

uterus, and have selected those cases which satisfied the following conditions<sup>1</sup>:

1. A radical operation, i. e. extirpation of the uterus

2. A microscopic corroboration of the diagnosis, or a history of subsequent recurrence or metastasis.

Cases under 25 years of age and obvious cases of cervix sarcoma, chorio-epithelioma, and carcinosarcoma have been left out of consideration, because they do not bear on the problem in hand

I presented the cases thus selected to Prof. Kronig, who answered the question whether or not he would subject each case to the X-ray treatment, using the indications which obtain in the Freiburg clinic as given in the monograph of Gauss and Lembeke. Among the 180 cases selected there were 9 in which an answer was impossible because of poor histories and findings; in some cases the diagnosis had been made previous to operation, and it must be assumed that it would also be possible to make the diagnosis to-day.

The results of the consideration of these 180 cases is as follows.

1. Of 180 cases, 55, or 30.5 per cent, would receive X-rays, 116, or 64.4 per cent, would not receive X-rays, 9, or 5 per cent, unknown.

(a) Of these 55 cases which would have received X-ray treatment, 7, or 12.7 per cent, under the operative treatment, were reported more than 12 months later as free from recurrence; 24, or 43.6 per cent, died following operation or from recurrence; 24, or 43.6 per cent, were not followed over one year.

(b) Of the 116 cases which would not have received X-ray treatment, 14, or 12 per cent, were reported over 12 months later as cured, 52, or 44.8 per cent, died following operation or recurrence; 50, or 43.2 per cent, unknown.

(c) Of the 9 cases where answer was impossible, 2 were alive over one year, 5 died following operation or recurrence, and 2 were not reported.

2. If we consider the different kinds of sarcoma separately, the following figures are obtained: There were 74 out of 180 reported

as interstitial in origin, of which 32 would have received X-rays, 39 would not, and 3 were doubtful.

(a) Of the 32 which would have received X-ray treatment, 3 were free from recurrence after 12 months, 16 died, and 13 were not reported.

(b) Of the 39 which would not have received X-ray treatment, 2 were free from recurrence after 12 months, 18 died, and 19 were not reported.

(c) Of the 3 doubtful cases, 1 lived over a year, 1 died, and 1 was not reported.

3. Only 3 out of 40 sarcomata of the uterine mucosa would have received X-ray treatment; 36 would not, and 1 case was doubtful.

(a) Of the 3 cases which would have received X-ray treatment, 1 lived over a year, 1 died, and 1 was not reported.

(b) Of the 36 cases which would not have received X-ray treatment, 1 lived over a year, 16 died, and 14 were not reported.

4. Of the 66 cases in which the origin of the sarcoma was not designated, 21 would have been rayed, 40 would not, and 5 were doubtful.

(a) Of the 21 cases which would have received X-ray treatment, 4 were free from recurrence over one year, 7 died, and 10 were not reported.

(b) Of the 40 cases which would not have received X-ray treatment, 5 were reported well after one year, 16 died, and 19 were not reported.

(c) Of the 5 doubtful cases, 1 was alive after one year, and 4 died.

If we consider the above given figures it must be admitted that, of the 55 cases which we should have treated with X-rays, 7 would perhaps have died under that treatment, whereas they were really reported after one year as cured. We can, however, be satisfied to have so few as 7 when we think of the high mortality and poor end results of the operative treatment.

Out of 74 interstitial sarcomata, 32 would have received X-ray treatment, i. e., if one may be allowed to say so, a mistake in diagnosis in 43.2 per cent of the cases. We do not go so far as to say that all the other cases could have been diagnosed, but many cases

<sup>1</sup>These cases may be seen in Table IV of my article in *Strahlen therapie*, Bd. 16, H. 1, 1913.

are excluded from the X-ray therapy on the ground of the contraindications to it and because of other conditions which in themselves would lead to operation.

The best diagnostic results are in the mucosa sarcoma group, where we should have made mistaken diagnosis in only 7.5 per cent of the cases.

We may reckon in general 2 sarcomata among 100 myoma cases, let us now consider a mistake in diagnosis of 43.2 per cent, and we should have, among about 125 myoma cases, 1 which through failure in diagnosis would be subjected to X-ray treatment. In this sense, then, one can reckon the mortality of the X-ray treatment as 0.8 per cent, which compares very favorably with the high primary operative mortality of myomectomy. This corresponds exactly to the experience in the Freiburg clinic, for of the 5 sarcoma cases we should have treated only 3 with X-rays, and one died anyhow following operation, which makes 2 out of 318 myoma cases, or 0.63 per cent, as our theoretical X-ray mortality.

In the following pages I shall review briefly this experience. Since October 10, 1906, all myomata removed by operation in the Freiburg Frauenklinik have been carefully examined in the pathological institute under the control of Prof. Aschoff. Up to February 7, 1911, among 249 myoma cases not a single sarcoma was found. Between February 7, 1911, and July 28, 1912, there appeared suddenly 5 sarcomata among 69 cases. It would be wrong to draw any conclusions from either series of cases. As Schottlander says, "The principal reason for the high figure (5.7 per cent—Basso) may perhaps be the relatively small number of cases and the appearance of relatively many malignant changes within a short period of time."

In the space of time between January 1, 1909, and February 7, 1911, 47 myoma cases were treated entirely by X-rays, between February 7, 1911, and July 28, 1912, 138 myoma cases were rayed. No one of these has up to the present time shown signs of malignancy.

Among the 318 operated myomata were 5 sarcomata, i. e. 1.6 per cent. If we reckon the X-ray cases with these, we should get 501 myomata with 5 sarcomata, or 1 per cent. Furthermore, had we as a matter of principle treated every case with X-rays, we should still have rayed only 3 out of the 5 sarcomata. Case 2 was pregnant, and Case 5 was previously diagnosed. Again, Case 1 died after operation; she could not have done worse had she been treated with X-rays, the probabilities being in favor of prolongation of life for several months.

The individual histories are given below.

**CASE 1.** A 50-year-old peasant woman, who had suffered for 10 years with heart trouble following influenza. The first menstruation appeared at the age of 14 years, the last menstruation was 4 days previous. Patient has had no children. The menstruation has become stronger during the past year, aside from that, the patient complains of shortness of breath, cough, expectoration, and constipation. For the last 3 months, pains in the right side when lying on the left side. For one month, ischuria.

**Examination.** Hbg. 45 to 50 per cent; urine shows traces of albumin. Patient is poorly nourished and short of breath. The uterus cannot be well felt; the cervix is drawn high up, the vagina funnel-shaped, and the uterus could not be sounded. A hard tumor fills the pelvis and reaches the umbilicus. **Diagnosis.** Myomata uteri, ischuria paradoxa, myodegeneratio cordis. **Operation.** June 26, 1911, morcellation and supravaginal amputation of the uterus. Exitus after 20 hours. **Pathological report.** Spindle-cell sarcoma, interstitial type. Lung metastases.

**CASE 2.** A 36-year-old factory worker, who has always been well. Menstruation was without unusual features. The last period was 5 to 6 months ago. During the last 4 months the patient has complained of abdominal pain. The abdomen has rapidly grown.

**Examination.** Uterus anteverted, drawn to the left, and about the size of a fist. It is pressed to the left by a tumor twice as large, which feels hard. The vagina is relaxed as in pregnancy, but is not bluish in color. The cervix is open. Uterus on sounding measures 14 cm. The breasts contain colostrum. **Diagnosis.** Pregnancy in the fifth to sixth month; myoma (tumor of the ovary?). **Operation.** May 18, 1911, total extirpation, with the left adnexa. Discharged on the 17th day. **Control examination,** June 5, 1912; no recurrence. **Pathological report.** Puerperal uterus. Myoma which shows many cells, some of atypical structure and nuclear form, with relatively many mitotic figures, so that the diagnosis of myosarcoma must be made.

**CASE 3.** A 40-year-old woman, a conductor's wife, who has had 5 children. Periods at first weak, have become stronger during the past year. Patient

complains of headache, backache, abdominal pains, dizziness, and shortness of breath.

**Examination** Pale, moderately well-nourished woman. Systolic murmur at the apex, increase of the second pulmonary sound. Uterus hard, enlarged, movable. On one side of the uterus is a tumor. **Operation.** September 9, 1911, total extirpation. Highest temperature was 39.2° on the sixth day, when a slight thrombosis developed. Since the report came that the tumor was malignant, an inguinal gland which was swollen was removed on the 17th day. It was reported negative. Discharged on the 26th day, cured. **Control.** April 5, 1912, inguinal glands slightly swollen, no signs of recurrence. **Pathological report** Myoma with myosarcomatous parts.

**CASE 4.** A 47-year-old woman, a day laborer's wife, who has had 3 children and one abortion. The last birth was 20 years previous. Menses have been regular, weak, and somewhat painful. Patient seeks medical advice because of pains in the abdomen and back, which occur before and after menstruation.

**Examination** Pale, well-nourished woman; weak presystolic murmur at the apex. Vagina narrow, cervix closed, uterus the size of a fist, retroverted, hard, and fixed. The adnexa are not to be felt. **Diagnosis** Myoma uteri. **Operation.** February 7, 1911, Ext. tot., cum adnexis sinistris. Highest temperature, 37.9° on the sixth day. Discharged as cured on the 16th day. **Control.** June 23, 1912, no recurrence. **Pathological report** Suspicious tumor which shows rather numerous short spindle-cells, which can be called (suspected) sarcomatous. No destructive growth is to be seen.

**CASE 5.** A 56-year-old peasant, who was never sick; II-para. Two years ago, when the patient was operated on in this clinic, the following notes were made:

Patient complains of a fullness and pressure in the abdomen, with shooting pains and increase in size **Diagnosis.** Cystoma ovarii (carcinomatosis peritonei?). **Operation.** November 4, 1910, cystomectomy dextra, Salpingophorectomia sinistra, appendectomy. Difficult on account of adhesions. Following the operation, menstruation ceased. During the last 15 months there has been a vaginal discharge, which grew more copious and ill smelling. Patient has lost weight. **Examination.** Stinking vaginal discharge. The cervix admits one finger and contains disintegrating, easily bleeding tumor masses. To the right of the uterus, a small tumor the size of a plum. Parametria not involved. **Diagnosis.** Submucous myoma or corpus carcinoma. Pieces of the tumor removed gave the following microscopic findings. The pieces of tissue are largely hemorrhagic and necrotic, and in single instances around the blood-vessels is a zone of large, plump spindle-cells. It is a case of spindle-cell sarcoma, perhaps myosarcoma. **Operation.** December 20, 1911, Wertheim extirpation, with preliminary camphor oil treatment. The wound later became necrotic and healed slowly. Discharge on the 29th

day. **Control.** June 5, 1912, no recurrence. **Pathological report.** The diagnosis of sarcoma is confirmed.

Let us now consider the cases reported by Warnekros.<sup>1</sup> Is he justified in saying that his seven sarcoma cases would have surely died if X-rays were the routine treatment? Prof. Aschoff was kind enough to help me answer this question by criticising the microscopical illustrations accompanying the article of Warnekros. His answer, based on the illustrations, was that only Cases 2 and 7 can be considered as undoubted sarcoma; Cases 1, 4, and 6 are doubtful, and in Cases 3 and 5 he could not agree with the diagnosis of sarcoma. In Case 7 it is to be regretted only an enucleation was done. Case 6 was 54 years old, and we should have used X-ray treatment cautiously; and if it had not reacted within a very short time, we should also have operated.

Even if all these cases had been treated by X-rays, it does not follow that they would all certainly die because of false treatment; we know, indeed, that X-rays have a destructive action on carcinomatous and sarcomatous growths in other parts of the body, so that such an action might even be expected in these cases under the intensive X-ray treatment as it is carried out to-day. This checking action of the X-rays may indeed give us the right to use the X-ray treatment conditionally in uncertain cases, and later undertake operation, without making any great difference in the chances of cure.

The four cases of Bumm, which Warnekros also reports in his paper, agree with the answer I made to question No. 3. Four out of 200 myoma cases died later of sarcoma recurrence, in spite of the radical operation. We should furthermore have treated only 2 of the 4 cases with X-rays. Case 2 was 63 years old and had a typical history of corpus carcinoma, and Case 3 we should probably also have operated on because of her intestinal symptoms.

The fears of Warnekros seem, therefore, to be well grounded, and indeed it appears all the more so since even those who formerly were its bitterest opponents have lately

become enthusiastic users of the X-rays in treatment of myoma of the uterus.

The fear of the knife does not exist, as Flatau says,<sup>1</sup> "in indirect proportion to the trustworthiness of the physician in question." For the public, the timidity in facing operation plays a great rôle, and one will always have to reckon with it. Sarwey, indeed gives us definite figures concerning it. He reports that of 460 patients who should have been operated on, no less than 30 could not take the treatment, and 10 indeed absolutely refused. He found out later that no less than 6 of these died, probably because of lack of treatment. He does not reckon these cases however, in his mortality list. It is therefore self-evident that the figures given as primary mortality of the myoma operation do not tell the whole story.

#### RÉSUMÉ

To sum up briefly, I may draw the following conclusions

1 Sarcoma may be said to occur in about 2 per cent of all myomatous uteri

<sup>1</sup> *Ztschr f Geburtsh u Gynak* 1912 Bd LX H 3

2 The primary mortality of the operative myoma therapy is still about 4 to 5 per cent

3 A lasting cure of sarcoma of the uterus by the operative treatment can only be expected in 25 per cent of the cases at most

4 Considering the advantages of the X-ray over the operative treatment in regard to assured freedom from fatality, mistakes in the diagnosis of sarcoma amounting to 0.8 per cent make little difference

5 When the public learns that not every tumor of the uterus demands operation, but that there are also efficient conservative methods, we shall certainly be in a position to get hold of more malignant growths in the curable stage

In view of the above facts I believe there can be no further doubt that a routine operative treatment of myoma of the uterus, for fear of sarcomatous degeneration, need not be carried out. This ghost should be buried at once

It is my pleasure to thank Prof. Kronig for the suggestion of the theme and for the free use of his material and Dr. Schlimpert for his kind assistance in the preparation of the paper



# DEPARTMENT OF TECHNIQUE

## A REPORT ON TWO CASES OF CERVICAL RIB AND AN OPERATIVE MEASURE TO PREVENT RECURRENCE OF SYMPTOMS

By C. HUGH McKENNA, M.D. CHICAGO

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**A** REVIEW of the literature on neuritis of the upper extremities convinces one of the fact that until recently many cases of supernumerary or cervical rib passed unrecognized.

Embryologically, the anterior portion of the transverse process of the cervical vertebra is the "anlage" of a rib. Why this structure in the seventh cervical vertebra should continue to develop in certain cases and not in others cannot be definitely determined.

For a number of centuries anatomists have recognized extra cervical ribs, but this anomalous condition was not associated with the clinical phase which we now know these ribs produce.

The X-ray, properly interpreted, has done much to bring out the underlying cause of so-called brachial neuritis. Not infrequently surgeons meet cases where inexperience in the use of the X-ray has led physicians to make an incorrect diagnosis of bone lesions. I mention this from the fact that, in the first case reported in this paper, two medical men failed to recognize a cervical rib with the use of the X-ray, even after the case had been reported to them as one of supernumerary rib.

I believe the complete and permanent success of the operation for the removal of a cervical rib depends principally upon two points in technique: (1) An incision that gives easy access to the rib, so that it may be removed entirely with a minimum amount of trauma to the brachial plexus and subclavian vessels, (2) The proper protection of the plexus and vessels from the upper surface of the first dorsal rib, which has been denuded of its periosteum by the removal of the osseous attachment of the distal end of the offending cervical rib.

In the author's plan of operation, an incision is made from a point midway between the origin and insertion of the sterno-cleido-mastoid muscle and along its posterior border in a straight line to the lower border of the clavicle. A second incision is made parallel to the first, and two inches poste-

riorly from the anterior edge of the trapezius muscle, to a corresponding point on the clavicle. These two incisions are now connected by a third incision, carried over the clavicle as shown in Fig. 1.

Figure 2 shows the author's method of employing a portion of the scalenus medius muscle to cover the upper surface of the denuded first rib, thereby forming a cushion for the brachial plexus and subclavian vessels.

Figure 3 illustrates the position of the nerves and vessels lying on their new bed of muscle tissue taken from the scalenus medius muscle.

Closure of the wound in the ordinary way. The arm is wrapped in an abundance of cotton and placed on a posterior splint.

### HISTORY OF CASES

**CASE 1** referred by Dr. S. J. McNeill. Mrs. J. age 37, housewife, June 23, 1911. *Family history* Father dead of locomotor ataxia; mother's death sudden, cause unknown, one brother living and in good health, one sister living and in good health, one dead, by accident. *Personal history* Usual diseases of childhood. Patient claims that since childhood she has had poor circulation in her hands, particularly the right hand. For the last two years there has been severe pain in the right hand. Since the last nine months there has been a constant aching pain in the right hand. She has noticed difficulty in closing the hand, also difficulty in using the member to put up her hair. In December, 1910 patient accidentally burned the right middle finger, which caused a deep ulcer.

Examination of the right hand and arm showed marked muscular atrophy and weakness, disturbed sensation throughout the arm. There were ulcers on the thumb and all the fingers. The ulcer on the middle finger deserves special attention since it represents the communication with a pathological compound fracture of the second phalangeal bone of that finger, brought about by a disturbed circulation and necrosis. *Examination of the right side of the neck* A well marked bony tumor could be made out on the right side of the neck, above the clavicle, between the posterior border of the sterno mastoid muscle and anterior border of the trapezius muscle. X-ray pictures showed this tumor to be a bony excrescence of a cervical rib at the point where the brachial plexus and subclavian vessels cross that structure.

**CASE 2**, referred by Dr. A. H. Bauer. Mrs. M. M. age 23. *Family history* negative. *Personal history*

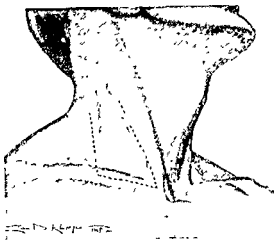


Fig. 1

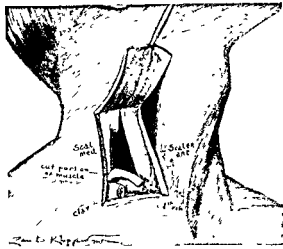


Fig. 2

Housewife, two children, no miscarriages, never sick before. Menses normal and regular, urination normal, bowels regular. Present condition: Gradual onset, with increasing weakness and coldness of right arm and hand, began about two years ago. Grasp of hand weak, right forearm thinner than left, patient is right handed. Examination: Medium size woman, bones are light, fair development. Head negative, chest negative, abdomen negative. Right arm shows muscles flabby and atrophied, the arm is thinner than the left, especially below the elbow. Muscles of thenar eminence especially wasted. Fingers of right hand appear long and thin. Grasp of this hand weak. Arm and hand cold. Has difficulty in picking up pins. X-ray pictures show a well-developed cervical rib on the right side and an undeveloped corresponding rib on the left side, represented by a short costal projection attached to the transverse process of the seventh cervical vertebra.

Case 1 is particularly interesting from the point of view of age. In the relatively large number of cases reported in the literature of this subject, the majority of the patients began to show symptoms long before the twenty-fifth year. The late age at which this patient began to complain of her distress may partially be accounted for from the fact that for the past five years she was of the Christian Science persuasion. Her "belief" may explain the endurance of pain during the period, beginning with an ulceration of the right middle finger and ending with a complete compound pathological fracture of the second phalangeal bone of that digit, at which time she presented herself for surgical intervention, and which represented a period of nearly two years.

Referring to the post-operative history of this case, I wish to place special stress upon the length of time paralysis remained in the entire right arm—a few days short of two months. This

temporary nerve disturbance obtained despite the fact that the most detailed precautions prevailed in protecting the brachial plexus from the slightest stretching or injury during the operation. After two months, however, the paralysis disappeared and recovery was very rapid, so that at this time—over a year after the operation—the patient has a perfectly normal condition in her arm and hand.

The broken finger bone above referred to was amputated a month after the original operation, when the circulation had improved following the removal of the offending rib.

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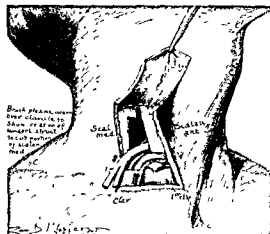


Fig 3

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## LATERAL INTESTINAL ANASTOMOSIS; A MODIFICATION OF THE FERGUSON-GRANT METHOD

By RAYMOND C. TURCK, M. D., JACKSONVILLE, FLORIDA

A NUMBER of methods for the lateral union of intestine have as a prime consideration the completion of as much of the suturing as possible before making the anastomotic incision, the object being to avoid soiling the field of operation with bowel contents, which is the inevitable accompaniment of all operations in which the bowel is widely opened before the sutures are inserted.

These procedures may be divided into two classes: those in which suture alone is employed, and those in which some mechanical aid is utilized. In none of these operations has it been possible to absolutely prevent leakage of material from the bowel, and many of the methods offer further disadvantage, in that there is a tendency to over-manipulation of the gut and to faulty suturing.

Of such procedures by suture without mechanical aid, the Halsted method of placing and tying the lower row of stitches and inserting the upper row of sutures before making the incisions in the bowel most nearly fulfils the first indication, yet it is necessarily a slow operation because interrupted sutures are employed, there is a possibility of leakage between sutures, and even if the writer's leak-proof interlocking suture is used there is still danger from hemorrhage from the cut mucosa, there is inevitably much handling of gut, with the possibility of subsequent shock, there is undoubtedly a lesser degree of safety in any intestinal reparative operation in which dependence is placed upon but one layer of sutures — disadvantages which should condemn this procedure and all others of its type.

The merits of the numerous permanent, sub-permanent, and temporary mechanical aids have been widely discussed and tested, and I believe a majority of surgeons are of the opinion that anastomotic operations which, when completed, leave behind no foreign body other than suture material, are eminently the most satisfactory, certainly the most surgical.

The ideal intestinal anastomosis should combine the following essential features:

A. Accurate approximation of peritoneum entirely around the anastomosis. This, the basic principle of Lembert, must be considered the foundation of all gastro-intestinal repair.

B. The cut edges of the mucosa must be secured, to prevent hemorrhage, and to this

might be added, to prevent absorption of infectious material through unsutured raw areas.

C. The method of suturing should be simple and easily understood and should provide for rapid insertion.

D. The completed anastomosis should be proof against leakage, and should be made with two rows of sutures — the first to secure mucosa and roughly approximate peritoneum, the second row to accurately approximate peritoneum and act as a second line of defense in case of an infection or slough in the area of the first stitch line.

E. There should be but a minimum of bowel handling as a provision against secondary shock.

F. There should be but little, if any, contamination of peritoneum about the operative area.

Lateral anastomosis with the Roosevelt or Moynihan clamp, if made with two rows of continuous sutures, is a very satisfactory procedure, the disadvantages being the possibility of injuring the bowel wall by pressure of the clamp beyond the anastomosis and the usual danger of peritoneal infection from escape of small amounts of bacteria laden secretion. The Murphy button, the Dawson potato plate, and other devices of their type are open to the principal objection, that is, possible peritoneal contamination.

Ferguson of Chicago presented before the Chicago Gynecological Society of 1900 a modification of Grant's enterotome clamp for the facilitation of lateral anastomosis and gastro-enterostomy. The instrument consisted of a forceps with grooved blades and a spade-like enterotome made to slip in the groove when the blades were closed. With this instrument it was possible to complete all the suturing before any opening in the bowel was made other than the small punctures through which the blades entered. In practice, however, it was found that while the use of the forceps aided materially in the placing of the sutures and provided a minimum of bowel handling, it was very difficult to cut through the septum with the sliding knife, and for this reason the instrument obtained no general use. At about this time the writer devised an emergency lateral anastomosis, using a phimosi forceps in place of the Ferguson-Grant enterotome, cutting the septum with a round-pointed curved bistoury after the completion of the suturing.

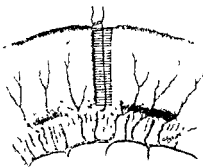


Fig 1 Showing bowel crushed by forceps and ligature placed ready to tie

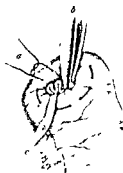


Fig 3 Redrawn from Kelly Noble, Vol II A, purse string suture to bury ligated stump, B, tissue forceps invaginating stump, C, cut edge of mesentery with vessels ligated



Fig 4 Purse-string suture tied and stump buried Cut edge of mesentery secured by whip stitch

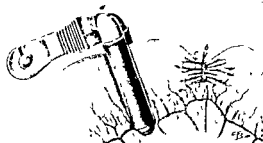


Fig 2 Showing ligature tied at b, Murphy clamp at a to prevent escape of bowel contents, dotted line at c where bowel is to be divided by cautery

The forceps here presented is simply an ordinary phimosi forceps lengthened, curved on the edge and made heavier so as to act as a crushing instrument. Gastro-enterostomy has been done with this instrument, but it seems to work out particularly well in all anastomoses of small intestine or in union of small and large bowel.

When bowel ends are completely severed, the method of closure of the ends is worthy of some consideration. The bowel should first be clamped by heavy angiotribe forceps and a ligature placed at the point of crushing, as shown in Fig 1. The ligature should be passed through the mesentery with some blunt instrument such as a mosquito forceps, blunt ligature carrier, or with a needle passed eye-end first. No sharp needle should ever be passed through mesentery, because of the danger of puncturing mesenteric vessels. The ligature having been tied, the distal end of the bowel should be gently stripped with the fingers to force back all the fecal content possible, and a Murphy clamp placed as

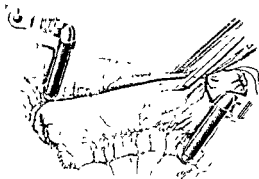


Fig 5 Bowel approximated so that peristalsis is not reversed. Traction suture to facilitate insertion of forceps blades through small punctures. Murphy clamps to further prevent escape of bowel contents

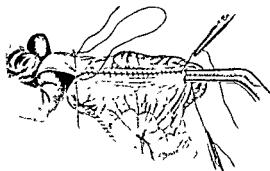


Fig 6 Forceps inserted, closed and first row of continuous suture passing through all coats begun

shown in Fig 2. The best practice then is to divide the bowel with the actual cautery at the line shown at C in Fig 2.

The mesentery having been divided and any spurting vessels ligated with fine catgut, a Lembert purse string suture is placed as shown in Fig 3 and the stump inverted and buried by tying the purse-string as shown in Fig 4. The cut edge of the mesentery should then be sewed over with a continuous whipstitch, as shown in Fig 4.

Both bowel ends having been thus treated, the bowels are laid side by side, always making certain that peristalsis is not reversed. A single stitch of the Lembert type is inserted to act as a traction suture, small punctures are made in each loop of bowel, and the forceps blades are pushed through into the interior of the gut, as shown in Fig 5. The punctures should be as small as possible, so that the bowel wall will fit snugly about the forceps blades to minimize the escape of bowel content during the operative work. The forceps is then closed tightly, so as to crush the intervening bowel wall. This will later cause a slough and still further increase the anastomotic opening. The only possibility of leakage of bowel content being along the sides of the forceps through

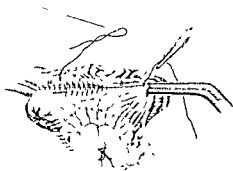


Fig 7 First row completed around both sides, second row continuous right angled Cushing's suture begun

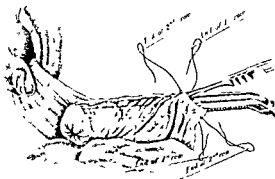


Fig 8 First and second row of sutures completed with ends left long, curved bistoury dividing septum through the fenestrated forceps blade

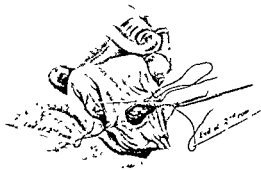


Fig 9 Forceps withdrawn and opening being closed. First suture line with the author's modification of the Connell suture



Fig 10 First row completed. Second row continued and tied to the first end, which has been left long



Fig 11 Completed anastomosis

the small punctures, as a further assurance against peritoneal contamination the forceps at point of entrance may be wrapped with a sponge moistened with a normal salt solution.

Beginning near the point of entrance of forceps, the first row of sutures is placed as shown in Fig 6. This suture should penetrate all coats of the bowel, and this can be determined by passing the needle each time until it is felt to be in contact with the blade of the forceps. The suturing is continued around the end of the forceps and back on the other side until it arrives at the point of puncture. This first row suture should be of linen or of chromic catgut. The ends should be left long, that they may be utilized in closing the opening which remains after the forceps are withdrawn.

The second row of sutures is then placed, beginning as before at the point of entrance of forceps and continuing around the end and up the other side to the point of puncture. This suture should be of silk and should be a continuous Lembert, or preferably a continuous right angled Cushing Lembert stitch as shown in Fig 7. A back or lock stitch at every fifth or sixth suture will prevent puckering and give additional strength.

Both rows of sutures having been completed on both sides of the forceps blades, a round pointed curved bistoury is then entered into the fenestrated forceps and the septum cut through, as shown in Fig 8.

The septum having been cut through, the forceps is removed, and there remains to be closed but the small opening through which the forceps entered. The first row of stitching is best continued by the Connell suture, which

penetrates all coats of the gut and inverts the cut edges, as shown in Fig 9. It will be noted that the Connell suture may be put in exactly as the right angled Cushing suture is placed, except that in the Connell the needle penetrates all coats of the bowel, taking a bite from peritoneum to mucosa, thence from mucosa to peritoneum, while the Cushing pierces only the peritoneal, muscular, and fibrous coats. The continuous Connell suture placed in this manner is very much easier of insertion than if the needle is completely drawn through each time it enters or emerges from the bowel, as described in Connell's original work. The principle and the final result are exactly the same.

It will be noted that in this operation there is but a minimum opportunity for peritoneal contamination through escape of bowel contents, more than 90 per cent of the suturing being completed before opening the bowel, the anastomosis is made with two rows of sutures, the first penetrating all coats of the bowel so as to prevent hemorrhage from the mucosa and secure rough approximation of peritoneum, the second row as an additional insurance against leakage and to insure accurate approximation of peritoneum, the anastomotic opening is made any length, from one to five inches, and is generous in width owing to the fact that there will be a slough of that portion of the bowel wall included between the forceps, there is but a minimum of handling of gut, because the bowel is held wherever desired and manipulated by the forceps instead of by traction sutures or the assistant's fingers.

A decided advantage in this type of forceps is that it does not matter how firmly the forceps is clamped, since a slough is desirable to increase the anastomotic opening, while in using the Roosevelt or Moynihan clamp, much care must be exercised that there may be no injury to the bowel outside of the operative area.

The writer desires to acknowledge the valuable assistance of Dr J Knot Simpson in the perfecting of the technique and in the preparation of the rough sketches which were so accurately redrawn by Mr Chas F Bauer of Philadelphia.



Fig 12 The author's fenestrated lateral anastomosis forceps

## A NEW OBSTETRICAL RUBBER DILATING BAG

By FREDERICK LEO GOOD, M. D., BOSTON

NO longer can there be any doubt as to the efficacy of the rubber bag in dilating the parturient cervix. Neither can there be any question as to its indispensability if we are to do good obstetrics. After using the obstetrical bag for the past five years, I am firmly convinced that it occupies a position second in importance only to the forceps. A rubber bag filled with water exerts an equal pressure in every direction; consequently it is the nearest possible approach to the amniotic bag of nature.

I feel that the ideal bag is one that will exert an equal pressure everywhere (a pressure on both the entire cervix and the lower uterine segment), that will not displace the head, and that is easy of introduction. Some bags in use to-day exert pressure on the cervix, but not on the lower uterine segment. Other wedge-shaped bags exert pressure on the lower uterine segment and on that part of the cervix in contact with the bag, but if the cervix is not "taken up" there are parts of it where there is no pressure, or at the best an uneven pressure.

I believe that this bag, photographs of which are here shown, overcomes the objections that I have mentioned, and withal it is easy of introduction.

Fig 1 shows the bag before it is filled with water. It is mushroom-shaped and has two separate compartments. Compartment A is for cervical pressure and compartment B for pressure on the lower uterine segment. Tube C is for filling compartment A, and tube D, which runs directly through compartment A, is for filling compartment B. The compartments are so joined that they give the appearance of but one bag. When ready to be introduced, the bag is easily folded on itself and either an hysterectomy or gastro-enterostomy clamp closed upon it. If the case

happens to be one not yet in labor or one with not enough dilatation, the cervix is dilated with a simple steel dilator sufficiently to allow the passage of the bag and clamp. I have found that if there is enough dilatation to easily admit the finger the bag can be introduced without any difficulty. After the bag is introduced, compartment B is filled with sterile water and traction made on tubes C and D. (Filling compartment B and then using traction accomplishes two things: (a) it prevents the bag from slipping out, and (b) it assures us that when compartment A is filled it (A) will be in close proximity to the cervix at every point.) Compartment A is now filled with water. There is then an equal pressure everywhere on the cervix from compartment A, and pressure from the wedge-shaped compartment B on the lower uterine segment. Compartment B will not do its greatest good until the cervix is well "taken up," and can either be left filled with water or emptied, to be filled again without removing the bag after compartment A has caused the cervix to be sufficiently obliterated. My object in first filling compartment B is to make certain of having compartment A properly placed against the cervix. After compartment A has caused all the dilatation that it is capable of doing, it should not be emptied, as one of its functions is to strengthen the base of compartment B.

Fig 2 shows the bag with both compartments filled with water. The wedge-shaped border of compartment B is plainly visible in the photograph ("E"). When compartment B is filled its top ("F") is concave, and at no place measures more than three quarters of an inch from its base to its upper surface. In other words, compartment B is nowhere more than three quarters of an inch within the uterine cavity (yet always

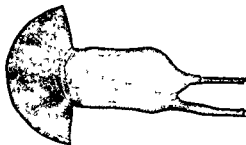


Fig 1



Fig 2



exerting great pressure), and cannot displace the head enough to make it of any consequence.

Compartment A is three inches long and  $1\frac{1}{2}$  inches in diameter. Compartment B is  $3\frac{1}{2}$  inches in diameter, and  $\frac{3}{4}$  inch from its base to its top. Its base being  $1\frac{1}{2}$  inches in diameter, its top  $3\frac{1}{2}$  inches in diameter, and its thickness but  $\frac{3}{4}$  inch, its wedge-shaped properties can be easily appreciated. Tube C and D are 15 inches long, allowing them to be folded on themselves and tied to prevent the escape of water.

The bag having been inserted, occasional traction is made in order to force the uterine contractions. I feel that cervical dilatation of  $3\frac{1}{2}$  inches (the diameter of top of compartment B,) is sufficient, for when such dilatation is obtained the patient is in hard labor, and contractions would follow in quick succession after the bag, having accomplished its purpose, was either precipitately expelled or ultimately removed by

traction. The conduct of the rest of the delivery depends on circumstances, and can be either normal or by forceps.

Another advantage of the above described dilator is that a single bag can suffice for all work, and it is not necessary to use a series of bags, starting with a small size and ending with a large one, though the bag can be made of different sizes if desired.

I shall not discuss the type of cases in which bags can and should be used. Strict asepsis is of the utmost importance. The syringe for filling the bag may be of either glass, metal, or rubber and should be thoroughly sterilized before using. The bag should be filled with sterile water. It is well to find out before introducing the bag how much water is needed to thoroughly fill each compartment. Then, after introduction, fill a syringe with that amount of water and inject it into the bag.

## RUPTURE OF THE UTERUS<sup>1</sup>

By BARTON COOKE HIRST, M D, PHILADELPHIA

IT would be interesting to treat this subject in its entirety were it not so complex, and had we time and patience for its full discussion.

From Bandl's discovery, in 1875, of the mechanism of the most frequent kind of uterine rupture in his time, we might trace with profit the steady development of our knowledge of the subject. Freund's explanation of conditions that determined rupture of the vaginal vault instead of rupture of the uterus, the fuller comprehension of the part played by the stretching of the round ligaments in the elevation of the upper uterine segment and the attenuation of the walls of the lower uterine segment, the recognition of a rigid cervix and degeneration of the uterine muscle as etiological factors, the interesting light thrown upon a rare variety of the accident in the collection of twenty-seven cases of repeated spontaneous ruptures of the uterus by Becker, with the addition of an original observation, the series comprising a period of one hundred and forty-two years<sup>2</sup>, and the information obtained by the clinical studies of spontaneous rupture of the uterus in pregnancy at the fundus—studies, it must be confessed, not enlightening us much as to the etiology of this peculiar occurrence,

although teaching us valuable lessons in diagnosis and treatment.

But I must forego too wide an excursion into the history and detailed description of an obstetric complication that has the greatest interest to us specialists, and must be, I trust, of some interest to the general physician, who may at any moment encounter this appalling accident in his practice. The scope of this communication is confined mainly to three points in connection with ruptured uterus.

First, that the accident is more frequent now than formerly, although with the progress of medicine it ought to be less frequent, for it is often preventable, it is an evidence, usually, of errors in diagnosis or faults of technique, and is rightly regarded as a reproach to the physician in whose hands it occurs.

Second, the diagnosis is not as easy as the general physician might suppose, in view of the distinctive symptoms and the gross nature of some of them. This is particularly true of spontaneous rupture of the fundus.

Third, the treatment is not to be dismissed by the rule of thumb—to open the abdomen in every case and to amputate the uterus.

The first statement is one, I think, to which the

<sup>1</sup>From Lambrom's case, 1779, to Becker's 1912.

<sup>2</sup>Read before the Springfield Medical Society December 10, 1912.

attention of the profession should be particularly called Ruptured uterus, as previous generations saw it, is not so frequent now; that is, the neglected or unrecognized cases of obstructed labor, with laceration of the lower uterine segment by distention of its cavity and ascension of the upper uterine segment by elongation of the round ligaments. What augments the number of cases now, if I may judge from what I see in consulting practice, is the hasty application of inappropriate means to extract the uterine contents or a clumsy effort to employ the right methods. For instance, in the writer's recent hospital and consulting practice, in a period of nine months there were six cases of ruptured uterus, every one of them from instrumental or manual interference.

In one case, an effort to evacuate the womb with a curette forceps at the third month, for what was thought to be eclampsia but was probably hysteria, resulted in a perforation of the uterine wall, the extraction, and the detachment of the whole twenty feet of the woman's small intestines!

In another case, the writer found a young physician with his arm up to the elbow in a woman's abdomen, the patient lay unconscious on a kitchen table. As an explanation the physician stated that the woman was five months pregnant, she had had a hemorrhage, which was interpreted to mean placenta prævia, he had attempted digital dilatation of the cervix, and version, but found his hand had perforated the vaginal vault and was in the peritoneal cavity, withdrawing it, he again attempted a dilatation of the cervix and was successful, but this time his hand passed through the uterine fundus and he again found it in the peritoneal cavity. Then, possessed with the not unreasonable idea that his patient must be bleeding dangerously from these two extensive ruptures, he pulled a pocket case from his pocket, opened the abdomen from ensiform to pubis, and through the incision grasped the bleeding uterus. It was necessary to tie the uterine and ovarian arteries and to pack the abdominal and vaginal wounds till the patient could be transported to the hospital. There a hysterectomy and closure of the abdominal wound with drainage was completed. Strangely enough, the patient died of pneumonia on the third day, and not of peritonitis. She had been taken to the hospital during a severe thunderstorm. As the uterine vessels of the broad ligaments were tied, there was a blinding flash of lightning and a deafening clap of thunder. The driver of a coupe in front of the house was knocked off his seat. In a conversation with the patient's husband a few months later, he said "Just to think, if my poor wife had not been struck by lightning as you finished your operation, she might have been alive to-day." This was the explanation given by the attending physician.

These cases illustrate deplorable tendencies of the day: a superficial medical education; a subservience to medical shibboleths such as "empty the womb for eclampsia," "dilate the cervix and do version for placenta prævia," and a hysterical obsession that something active and heroic must be done for all the different emergencies of practice.

The second proposition that the diagnosis is not always easy may be illustrated by these cases:

A woman was brought to the University Maternity by two physicians of many years' experience. One of them said that he suspected that the uterus was ruptured, because in his last examination he believed he felt the liver. The uterus was not only almost completely torn away from the cervix, but both the full term, overgrown infant's arms had been pulled off, and two feet of the woman's intestines, stripped from the mesentery, were hanging out of the vulva.

In another case, a physician said to the writer that he had been in attendance on a parturient patient for two days, the head had been easily felt until twenty-four hours before, when it had suddenly become inaccessible. The woman had complained of no pain and her physician had noticed nothing alarming in her condition, but it was found in the consultation that the uterus had ruptured, the child had been expelled into the abdominal cavity, and the woman was moribund, in fact, she expired before the physician and consultant left the room.

A third case was in the writer's service in the Philadelphia Hospital. Nothing unusual was noticed about the patient's labor or puerperium, but when she got out of bed there were sudden gushes of water out of the vagina. It was found by the uterine sound and a chemical examination of the fluid that the posterior uterine wall had been ruptured and that the perforation communicated with an encysted ascites.

A fourth case came into the Howard Hospital a month after delivery, with what I thought was an intraperitoneal abscess in the region of the umbilicus. On opening the abdomen a localized abscess was found in this situation, but the cause of it was a rupture in the fundus uteri, from tube to tube, that had never been suspected.

Finally, it must be remembered that many a case of ruptured uterus may be saved by gauze packing of the pelvic and of the uterine cavity. To illustrate, the writer, in performing a version and a slow careful extraction of the fetus for placenta prævia, ruptured the lower uterine segment, cervix and vaginal vault, which tore like so much wet paper. There was an onrush into the peritoneal cavity, into which the outspread hand could be passed. The pelvis was packed with gauze and so was the uterus. The uterine packing was removed in twenty-four hours, but the pelvic packing was left undisturbed for four days, when it was removed and replaced by fresh gauze. The patient made an uncomplicated recovery. It is interesting in this connection to recall the series of ten cases thus treated, recently reported from Germany, without a death.

On the contrary, if the rupture is anterior or lateral, if there is much intraperitoneal hemorrhage, if the placenta or fetus has escaped into the abdominal cavity, an abdominal section is required and most likely a hysterectomy. Moreover, the control of hemorrhage and the evacuation of blood clots may be the most difficult part of the operation. In a case in the writer's out-

patient department, labor was obstructed by hydrocephalus. There was a breech presentation. The student in charge failed to recognize the obstruction. The uterus ruptured. A consultant rapidly extracted the after-coming head, probably increasing the laceration. When the patient was brought to the hospital, she was as near dead from hemorrhage as anyone could be and recover. It was necessary to turn out the retroperitoneal blood clots as high as the kidney by incising the posterior parietal layer of the peritoneum, and it was only after a hysterectomy that the bleeding vessels could be secured.

Finally, if I might be permitted to offer advice to the general physician on this subject of ruptured uterus, it would run somewhat as follows:

Cultivate the ability and the habit of making exact diagnoses of the comparative size of fetus and maternal pelvis; estimate the degree of resistance to be overcome and the expulsive power available to overcome it; avoid hasty manual and instrumental interference and methods of extraction that must, from the nature and degree of the obstruction, prove futile; but do not delay the application of the appropriate method too long, bear in mind the symptoms of ruptured uterus and the fact that they may be far from distinctive in certain cases; be prepared to put into immediate effect the treatment apparently most suitable to the individual case, whether it be simply gauze drainage or a difficult, complicated major abdominal operation.

## THE AFTER TREATMENT OF SUPRAPUBIC PROSTATECTOMY<sup>1</sup>

BY G. KOLISCHER, M. D., CHICAGO

THE after treatment of this operation begins the moment the patient returns from the operating table to his bed. The special care of the field of operation will be considered first.

After the patient has been placed in bed, the distal end of the glass coupler is freed and connected with a long rubber tube. Then by means of a hand syringe the tube, the glass coupler and the bladder are filled with boric acid solution, and the end of the long tube is submerged into a few ounces of antiseptic fluid contained in a graduated glass jar which is placed on a level a few feet lower than the body of the patient, by the submerging of the free end of the filled tube a syphonage is established. As the frontal branch of the glass coupler is kept free of the dressings a permanent control over the drainage can be maintained, for instance, in the case of interference with the flow of the fluid by coagula or by air bubbles, the free flow will be restored easily by again injecting boric acid solution through the distal end of the tube into the bladder and then again submerging the free end of the rubber tube into the fluid of the receiving vessel. The graduation of this vessel permits the measuring of the secretion of urine in a given time by subtracting the original amount of fluid from the total amount of fluid collected. In order to prevent soiling of the bed and of the thighs and the perineum of the patient,

the penis is either placed in a urinal or a rubber glove is tied over the glans penis. The abdominal dressings are to be removed once in 24 hours, and at that time the application of the silver nitrate paste is to be renewed. Especial care to force some of this paste between the tube resting in the bladder and the tissues surrounding it is to be taken, as the effects of this silver tend to counteract the deleterious effect of the urine that may result from its contact with the denuded tissues. The glass coupler is also detached from the tube draining the bladder, and the viscus is emptied by gentle manual pressure on the abdomen, after which two ounces of a 20 per cent argyrol solution are injected through the bladder tube into the viscus. After this the glass coupler is reinserted and the connection with the long tube and the syphonage is re-established in the way above described and a fresh dressing is applied. While the laboratory experiment proves argyrol to be of only moderate bactericidal power, its clinical efficacy cannot be denied. Any prevescal packing or drainage is removed 36 hours after the operation.

On the third day the glass coupler is definitely removed and the bladder is flushed out through its drainage tube with a 1:5000 silver solution until the fluid returns clear, in order to remove all blood or pus coagula, after the bladder is again emptied by gentle pressure on the abdomen a 20

<sup>1</sup> See "Technique of Suprapubic Prostatectomy" in the October 1917 number of this journal.

per cent argyrol solution is injected. By a quick twisting motion the catgut suture fixing the tube in the bladder is now broken and the tube is removed. A longer retention of the tube would lead to pressure necrosis. After the removal of the tube silver nitrate paste is smeared into the fistula and the suture line is also covered with it. The abdominal skin is protected from the macerating effect of the urine by a thick coating of vaseline, which is renewed at each dressing. The whole field is covered with fluffed gauze and on top of that is placed an oakum pad, the dressing will be changed every time moisture has penetrated the padding.

As to the appliances devised for catching the urine flowing out of the suprapubic fistula, the Irving-Ferner cup apparatus cannot be employed in the early stages, because shortly after the operation the patients cannot stand the pressure of the cup on the suture line. It is useful later on in cases in which the fistula persists for several weeks. C. M. McKenna's double rubber apron can be applied in the early days following the operation without causing any discomfort, but as to keeping the patient dry it works satisfactorily only in rather fleshy individuals. With proper care the patients can be kept quite comfortable without any special apparatus.

Usually the patients begin to urinate about the seventh day after the operation, in case of its delay the passing of a few large calibred sounds will start the natural urination. It is helpful to instruct the patient to close the fistula by manual pressure during the attempt to pass urine through the penis. The healing of the fistula will be hastened by repeated cauterization with a silver nitrate stick. In case the granulations are particularly sluggish, dressings dipped in tinctura myrrhae are to be applied. The application of scarlet red had better be avoided for two reasons in old people the danger of anilin poisoning is always great, and secondly, the rapid epithelialization produced by this drug may also lead, as has been observed, to epithelialization of the canal leading down to the bladder, preventing closing of the abdominal fistula. In case of the occurrence of such an event for some reason or another, the sinus is to be thoroughly cauterized with a galvanocautic burner. This procedure is preferable to freshening the walls of the fistula by curetting, as this is often followed by a profuse hæmorrhage. Sometimes, in spite of all precautions, infection of the suture line occurs, when exquisite tenderness, dark red coloring, considerable fever, and pronounced increase of leucocytes point to severe infection, the whole suture line has to be laid wide open in order to relieve the

tension and to prevent sloughing of the fasciæ. This latter event is exceedingly serious, as it delays healing markedly and is almost invariably followed by a ventral hernia. Moist dressings are applied until the sensitiveness disappears, later on a 1 per cent silver salve with an addition of balsam of peru is applied. In case of pronounced kidney lesions the balsam is better dispensed with. The cleaning up and healing of such an infected wound is greatly furthered by the use of prolonged warm tub baths before each dressing.

In the case of a post-operative hæmorrhage of importance, it is first necessary to locate its origin to ascertain whether the bleeding takes place inside of the bladder or in the retrosymphical space. In the latter case the lowest sutures are opened and the prevesical space tightly packed with gauze. If the hæmorrhage comes from the bladder a double compression has to be used. A colpeurynter is introduced into the rectum and is distended to its capacity by filling it with water from a hand syringe, while a heavy sandbag is placed on the abdomen over the bladder region, the knees of the patient are kept in flexion by pillows. To increase the coagulability of the blood 10 cc of serum are injected hypodermically. Opening of the bladder for post-operative hæmorrhage and packing in order to check it, does not as a rule furnish very satisfactory results, firstly, the necessary manipulations often lead to severe infection, and secondly, the hæmorrhages very often recur after the removal of the packing.

The appearance of phosphatic concretions in urine after the first week signifies that the dissolving of the catgut on the inside of the bladder does not proceed satisfactorily, thereby producing a precipitation of urinary salts. This condition is treated by flushing the bladder daily with a 1:5000 salicylic acid solution. In rare cases it occurs that the granulations at the former site of the enucleated tumor persist even after the abdominal fistula has closed. This shows itself by occasional hæmaturia and by the appearance of phosphatic crumbs in the urine. A cystoscopic examination will ascertain the facts, in case these granulating areas lie close to the internal urethral orifice, they can be scraped off by introducing a slender uterine curette into the bladder and curetting them, while one or two fingers placed in the rectum control the movements of the instrument; this scraping is followed by flushing the bladder with an indifferent fluid and the instillation of a few drops of a 5 per cent silver solution into the again emptied bladder. In case that these granulations are located further back in the bladder, they have to

be curetted and cauterized through an operative cystoscope, either treatment soon succeeds in bringing about epithelialization of the granulating spots.

In the general after treatment the following points have to be observed after the syphonage is established, the patient is put on the Wernitz drop-by-drop rectoclysis, as a matter of routine, as fluid a 3 per cent glucose solution is employed. This solution is absolutely innocuous to the kidneys and is of a very high nutritive value, with a selective action on the heart. This irrigation is continued for three hours, when a rectal tube is inserted for an hour, and on removal of this tube the rectoclysis is again started. This process in turn continues until the patient is able to take enough fluid per mouth to maintain a sufficient elimination. In case the amount and quality of the urine should show that in spite of all this the action of the kidneys is deficient, in addition to the rectoclysis diuretin is to be given internally or with the irrigation, six grains three times a day. On the second day after the operation the patient is made to sit up in bed and is taught breathing exercises twice a day. On the third day the patient is taken out of bed and put into an easy chair. On the fourth day, if there are no strict contraindications the patient begins to walk around.

If for some reasons the patient is unable to re-

tain food on his stomach after the first 24 hours, a 3 three per cent glucose solution is injected hypodermically twice in 24 hours, 200 cc at one time.

It is very important to secure for these old people a sufficient amount of sleep. Hence if the sleep does not come naturally it has to be forced by the administration of veronal or a similar drug. The use of morphin on account of its detrimental influence on the kidneys has to be restricted to absolute necessity. The heart action has also to be carefully watched, and in case of dilation digitalis or one of its derivatives is to be administered. The seventh day after the operation is often of critical importance for the patient, as at this date in spite of good progress so far the kidneys will sometimes cease to act properly. As it is impossible at this period to measure the elimination by collecting the urine, the other signs must be particularly watched for. If the skin becomes dry, if the perspiration even after a bath is only scant and of a urinary smell, if the tongue is dry and the patient is drowsy, then the action of the kidneys have to be stimulated by all the means at our command: administration of diuretin, rectoclysis, hot packs over both the lumbar regions, and finally venesection if the pulse is of a very high tension. In case the patient should lapse and remain in a uræmic stupor, lumbar puncture has to be employed.

## THE TREATMENT OF TUBERCULOUS JOINTS<sup>1</sup>

By JOHN L. PORTER, M. D. CHICAGO

I doubt if there is any surgical disease which has been the subject of so much controversy as to methods of treatment, or which has been subjected to such a wide diversity of methods in treatment, as tuberculosis of the joints. But it seems to me that each year brings a little more unanimity of opinion, that we find ourselves discarding more of the multitudinous suggestions of doubtful value and, better than all, we are treating each case individually and following the distinct indications in each case, instead of treating every case by a method of fixed routine for which we are unable to give a logical reason.

There are three facts to be borne in mind regarding joint tuberculosis. First, tuberculosis of the joint in a person of normally good resistance is naturally a self-limited disease, second, it al-

ways results in deformity and disability; third, the amount of deformity and disability depends upon the extent and duration of the disease. When I say that joint tuberculosis is naturally a self-limited disease, I mean that when the patient's resistance is not weakened by poor nourishment, poor hygiene, or poor heredity, most cases get well, but, left untreated, the joints will show some permanent deformity and disability when recovery takes place. And since the amount of deformity depends upon the extent and duration of the disease, it must depend very largely upon the efficiency of treatment and the promptness with which it is begun. Knowing these facts, the indications governing any method of treatment are: First, increase the patient's resistance in every possible way, second, put the

joint into the best position for future usefulness when recovery has taken place, third, prevent the development of deformity so far as is possible I say, "so far as is possible," because in some joints it is not always possible to prevent all deformity. I have never seen a case of mid-dorsal spondylitis recover without some degree of kyphosis, and rarely does a tubercular hip get well without some shortening and loss of motion. But, knowing these things, it behooves to see that the patient is spared as much of the distressing deformity as we can, and that he recovers with as good function in the joint as possible. Treatment of tuberculous joints is logically discussed under the following headings: First, mechanical, second, surgical, third, complications, fourth, medical and hygienic.

#### MECHANICAL TREATMENT

Without doubt, the most valuable procedure in the treatment of any tuberculous joint is rest and immobilization. In fact, if these things are efficiently carried out, most cases will recover in from three to five years with no other treatment except attention to the general health. It is the one thing upon which I have come to depend, and all other treatment is used simply as an adjunct to it. But right here I want to say that immobilization, to be of any value, must be efficient, and the reason it has failed in some hands and has seemed of doubtful benefit in many cases is because it has been inefficient. Remember that joint tuberculosis is a chronic disease. I have seen two or three cases, out of many hundreds, that I thought recovered in a year. More require three years, and most of them take from three to five years under the best of care. So bear in mind that when you put up a hip in plaster of Paris for two or three months, and then, because the pain and spasm have passed away, discontinue it, you have not used immobilization. Nor in case of Pott's disease, when you have sent to the instrument-maker for a spine brace, and allowed the patient to take it off at night, and finally throw it away when the straps wore out or the band broke, have you used immobilization. Nearly every physician seems to recognize the necessity of holding the joint still, because almost every case that comes to me late in the disease has at some time worn some immobilizing apparatus, but usually only for a short time. So frequently I hear it said, "I took the cast (or the brace) off because I was afraid the joint would get stiff." No well joint is made stiff by immobilization, and a tuberculous joint will surely get stiff if it is not immobilized. In

other words, it is the disease, and not the immobilization, which causes the stiffness.

Immobilization, to be efficient, must be continued until the joint is well, and in cases of dorsal spondylitis I continue it long after I believe the tubercular process is cured.

While many cases of joint tuberculosis go on to marked deformity without much pain or spasm, a large percentage does suffer from both, and I know of no means of rapidly relieving the patient and overcoming the early deformity which is as efficient as traction in bed when properly applied. But everything depends upon the method of application. For the hip, the adhesive should extend from the upper third of the thigh to three inches below the foot, and there be attached to a spreader which is long enough to keep the adhesive from touching the malleoli. Then the adhesive is bandaged snugly to the leg, and the bandage sewed on inside and outside with a basting stitch to keep it in place. A cord is then attached to the center of the spreader and carried over a pulley at the foot of the bed, and from three to eight pounds weight attached to the cord, depending upon the patient's weight and comfort. The weight should never be great enough to cause pain, but just enough to tire out the contracted muscles, produce relaxation, and thus relieve the pain. If there is any flexion deformity, the leg should be elevated on an inclined plane, extending from the buttock to the foot of the bed, high enough to allow the lumbar spine to lie flat on the bed. When that is done, the pulley must, of course, be at the upper ends of the incline. After all is adjusted, lift the foot of the bed about six inches to prevent the patient slipping down. The same rules apply when traction is applied to the head for cervical or dorsal disease of the spine, except the inclined plane will not be necessary, and the head of the bed instead of the foot must be elevated. It is essential, too, in head traction, that the halter should be so adjusted that traction will be equal upon chin and occiput, or the patient will be uncomfortable. The patient should lie flat, without a pillow under the head, but with a thin narrow pillow made of a folded woolen blanket under the diseased vertebrae.

When the pain and spasm are relieved and the affected joint can be put into the proper position for permanent immobilization, the best fixation dressing for the first few months is plaster of paris. It is easily procured, and with a few precautions can be put on anywhere, by any physician, so as to be perfectly comfortable for the patient, and it can be made to immobilize any

joint more effectively than the best mechanical apparatus.

Plaster of paris should never be put upon the bare skin nor over absorbent cotton. The best protection is a garment of snug-fitting cotton underwear covered with a layer of sheet wadding, bandaged on firmly with a cotton roller bandage. For the hip, the cast should extend from the tenth rib to the toes, for the spine, it should extend from the sternoclavicular articulation to the trochanters. If the disease is above the eighth dorsal vertebra, the neck and chin must be included. These casts should be changed about once a month, to inspect the diseased joints and care for the skin. When all signs of progression of the disease have disappeared, and it seems evident that the process of repair has begun, it is safe to use some mechanical apparatus, though I believe that in the hands of one who is not skilled in the use of braces, the plaster of paris cast is safer throughout the entire course of the disease, for the simplest brace will get out of order, and the parents become careless in its adjustment, and unless a brace holds the joint firmly fixed all the time, it becomes a burden instead of a brace, and does more harm than good.

The simplest and most efficient spine brace is the old anteroposterior leverage brace designed by Dr Fayette Taylor. It must be made from accurate tracings of the spine and pelvis made with the patient lying prone, and then must be carefully adjusted after it is finished, so that just the right amount of pressure is exerted on the transverse processes of the diseased vertebrae, as it must be remembered it is a leverage brace, and when it ceases to act as a lever it is useless. The so-called crutch braces, made with an upright fixed to the pelvis band, bearing crutches which lift up the patient's shoulders, are useless unless the spinal uprights act as levers, and are constructed on an erroneous idea. The shoulder girdle is so loosely attached to the thorax that any pressure exerted by these crutches in the axilla sufficient to take any of the weight from the diseased vertebra would be unbearable to the patient. For the same reason all plaster jackets should be trimmed out under the axilla to allow the arms to hang normally and move freely. It is hyperextension of the spine that is aimed at in all apparatus for Pott's disease, not to lift the superincumbent weight, for by hyperextension the weight is shifted from the bodies of the vertebrae to the articular and transverse processes, and the pressure on the affected vertebrae is thus relieved and with perfect comfort to the patient.

For the hip there are two braces that have given great satisfaction in my hands. One, the Judson long hip splint, is to be used with traction when the disease is progressive and when it is desired to let the patient walk without crutches. The other is the Thomas hip splint, which necessitates the use of crutches the same as a plaster cast. The first is useful when the patient can be seen at least twice a month, and where the parents can be made to thoroughly understand its principle and depended upon to keep it accurately adjusted. The second is useful to maintain a fair amount of fixation in cases which are beyond the progressive stage, or where the patient cannot afford the more expensive traction splint.

*Bier's obstructive hyperæmia.* My experience with the so-called Bier's treatment or passive hyperæmia has been disappointing; but I do not charge that to the inefficiency of the treatment, but rather to the inefficiency of the use of it. I have only used the rubber bandage for producing the hyperæmia, and have had no experience with the vacuum apparatus. Some cases may have gotten well sooner than they would without it, but the improvement is so slow that many patients get tired of applying the bandage two or three times a day for three or four hours and few are willing to come to the office daily for a protracted period to have it applied. Those who have used it most persistently and accurately claim good results.

#### SURGICAL TREATMENT

Regarding operative measures for tuberculous disease, I can do no better than to quote from Sir W. Watson Cheyne in the preface of his book.

In preparing a second edition of my book on 'Tuberculous Disease of Bones and Joints,' I have been much struck by the alteration which has been taking place in connection with the question of operative treatment. While there is very little to alter or add as regards the morbid anatomy and pathology of these diseases, there is no question that operative interference is very much less frequently employed at present than it was at the time when the first edition was published. When the tuberculous nature of these diseases was first demonstrated, the views as to the prognosis of tuberculosis were much more gloomy than they are at the present time, hence operation was very largely carried out with the view of attempting to eradicate the disease, as well as to obtain a good functional result. Since that time, however, experience has been accumulating, and has shown that, with careful hygienic and local treatment, the outlook of tuberculosis, especially

of the forms met with by the surgeon, is more favorable than was at that time thought, and the frequency of operations, especially at the early period of the disease and in the absence of suppuration, has been steadily diminishing."

The chief points to be considered in deciding whether to attack the diseased joint surgically are:

1. The age of the patient.
2. The local condition of the joint involved.
3. The general condition of the patient as regards his resistance, and evidence of toxæmia.

(a) Radical operations in children should be avoided, if possible, as it is certain to interfere with the later growth of the extremity, and the chances of recovery with good result under mechanical treatment and good hygiene are much better in children than in adults.

(b) In cases where there is extensive destruction, not only of joint structures but of bone, with probable sequestra and invasion of periarticular structures, operation looking to a general clearing out of the infected area by clean incision into healthy tissue is undoubtedly warranted, and especially if the patient is doing badly.

Then again certain joints are notoriously unfavorable for mechanical treatment in adults, as for instance, the tarsus. I think it is a safe statement to say that early amputation of the foot in disease of the adult ankle would be the most conservative treatment in 90 per cent of those cases, while in children the same joint shows remarkably good results under mechanical treatment.

(c) We are all familiar with those cases seen most frequently in young adult life, in which there is no resistance to the disease, the early toxæmia is marked and profound, and the patient steadily and rapidly grows worse. In such cases the only indication is to separate him from his infected focus as completely as possible, even to the extent of amputation, and then give him the benefit of outdoor treatment, tuberculin, and every other possible measure to save him.

Much might be said about special procedures for certain joints. Excision of the articular surfaces of the knee looking to early ankylosis has a strong advocate in Ely. Huntington would tunnel the trochanter and neck of the femur in all hip cases. But, while these may all be of value in certain selected cases, it is a very doubtful if they are advisable as routine methods.

#### ANTISEPTIC INJECTIONS

For several years the injection of antiseptic solutions into the affected joint and the surrounding tissues was a favorite procedure of some sur-

geons. The antiseptic most frequently used was iodoform, suspended in glycerin or oil. Like others, I tried it in a long series of cases, and have discontinued it. I remember just one case, a knee-joint, where I thought it was helpful. I know that the idea has been very generally accepted that iodine has more curative or inhibitive effect in local tuberculous infections than any other drug, but, after fifteen years' experience, and having given it faithful trial in various forms, I have come to the conclusion that I want to be shown, for I have never seen any evidence of it myself.

Moreover, I do not believe it is a rational surgical procedure to inject an insoluble substance blindly into a tuberculous area, in the hope that it may hit a spot where it may do some good. Certainly if we stop to remember that in nine cases out of ten the primary focus of infection is in the bone, and not in the joint, and that, long before the joint becomes invaded and we get ready to inject, the disease has spread in various directions through the joint structures accompanied by granulation tissue,—if, I say, we carry that picture in our minds, we should certainly realize that a blind injection of iodoform or any other substance into the joint has about one chance in ten thousand of ever reaching the deep-seated foci which are causing the trouble. And unless we can reach them, what possible good can the injection do? There is just one class of cases in which I believe antiseptic injections may be useful, and I frequently use them, but I do not use iodoform. Those are the primary synovial cases, seen in young adults (twenty to forty years of age), and beginning as a subacute synovitis, with gradual swelling, little or no pain, and slight disability and limitation of motion. For such cases, if seen before the disease has penetrated the joint structures and invaded the bone, I inject a mixture of three per cent of formaldehyde solution in olive oil. Formerly I used glycerin instead of olive oil, but glycerin is so hygroscopic and irritating that I abandoned it for olive oil. My experience with this has not been sufficient to warrant definite conclusions, but it seems to me that some cases have improved more rapidly than others have without it.

#### COMPLICATIONS — ABSCESSES, SINUSES, AND SPINAL PARALYSIS

*Tubercular abscesses.* We have all of us been for so long imbued with the idea that all abscesses should be opened and drained as soon as fluctuation is detected, that we have failed to see that a so-called tubercular abscess is not an abscess at



all, and that the rule did not apply. We have been a long time learning that a patient with a simple tubercular infection, though he may have an abscess as large as his head, is more fortunate and has infinitely a better chance of recovery than a tuberculous patient with a mixed pyogenic infection added to his tuberculosis. We, who would never think of opening an uninfected knee-joint or cystic tumor except under the strictest asepsis, and have always closed such wounds immediately for fear of infection, have cheerfully opened sterile tubercular abscesses, stuck in drains, and condemned the patients to dress infected sinuses for months or years, and thought we did good surgery.

I have seen scores of patients with large abscesses, so-called, who had little or no temperature, gaining weight and doing well in every way, and after the abscess was opened and drained I have seen them lose weight, the temperature go up, appetite fail and the patient grow worse, and possibly die, from septic infection. And I have quit.

I believe there are just as positive indications for opening tuberculous abscesses as there are for any other aseptic operation, and that they should be opened only when those indications are present. While I have opened many such abscesses in the past eight years, I have never drained them, and my results have been so much better that I have simply wondered why I ever did it before.

*Indications.* When a tuberculous abscess is so situated or is so large as to interfere with mechanical treatment, it should be evacuated.

When it is burrowing so rapidly as to threaten the integrity of subcutaneous tissues to any considerable extent, it should be evacuated. When the patient has a persistent high temperature with indications of toxæmia, and is doing badly, if an abscess is present, it should be evacuated. If the abscess shows signs of probable rupture, it should be evacuated. If secondarily infected, open and drain, and only then.

*Technique.* I never attempt to evacuate such an abscess by aspiration or by puncturing with trocar and cannula, because both methods are irrational and inefficient. Anyone who has ever seen the contents of a tubercular abscess, containing cheesy masses of various sizes, flakes of coagulated fibrin, and often small bony sequestræ, must realize that such can never be evacuated through a trocar, and those are just what must be expelled to do any good.

I make an incision large enough to admit my finger, not at the most dependent site, but through healthy skin alongside instead of over the abscess.

The contents are gently expelled and the cavity is gently washed out with normal salt solution, sterile water, or some mild antiseptic. When the water returns clear the fluid is all pressed out gently, and the edge of the wound is sponged with bichloride and tightly closed with deep sutures. Then a large compress is snugly bandaged on so as to keep the walls of the cavity in contact as much as possible, and the patient is kept in such a position as to prevent tension upon the line of incision until after it has healed. By this method we relieve the tension inside the abscess, allowing the walls of the cavity to collapse without infecting the cavity. I have become convinced that it is impossible to dress an open wound leading to such a cavity for more than a week without its becoming infected, even under the most ideal hospital conditions. Sometimes this method of evacuation disposes of the abscess permanently, but usually they fill up again although not so full. They may have to be evacuated several times, each time becoming smaller, but it is far better for the patient to have it done a dozen times, as it can be done with local anæsthesia without pain, than to have it drained once and become infected.

*Sinuses.* What to do with old infected sinuses leading to tuberculous bone foci, often discharging for months or years, has long been a puzzle to the surgeon. Constant irrigation with antiseptic solutions certainly does no good, and I believe does harm. Curettage is worse than useless, as it simply exposes an increased area of raw surface to infection. Open incision is futile unless it reaches and removes the foci of infection. So for many years I simply let them run, keeping the skin clean and depending upon Providence and the patient's resistance to finally close them up, and if the patient lived long enough they usually did.

The introduction of bismuth paste a few years ago by Carl and Emil Beck promised a valuable adjunct in their treatment, and I believe it is in selected cases. But it has not proven the miracle worker that was originally claimed for it. I am convinced that its value is purely mechanical, and that a paste made with any insoluble inert powder will do exactly as well. A sinus is a collapsible tube, the cells lining it are macerating in the oozing moisture and being constantly washed away. The paste dilates the sinus, keeps its walls separated, and supports the newly formed cells until they are sufficiently organized to live, and perhaps stimulates by contact the activity of the indolent granulation tissue lining the sinus walls. Its use in sinuses leading to large cavities

is dangerous, both from blocking up of the discharge and toxæmia, and from bismuth poisoning. Emil Beck has himself reported several cases of bismuth poisoning, and I have seen four, with two deaths, and in the light of such experience it seems little short of criminal to open up large tubercular abscesses and, after evacuation, fill them with bismuth paste, as has been recommended by some. It is in the old indolent sinuses, discharging a few drops of watery fluid a day and connecting with no definite cavity, that it seems to be most useful, and I am continuing my use of it to such cases, and with much satisfaction.

When the interest in Wright's opsonic treatment was at its height, two years ago, I had quite a large series of cases given the treatment with tuberculin after Wright's method. It was done by expert laboratory workers, who were trained by a colleague who had spent some time with Wright in his laboratory, and the cases were nearly all patients in St. Luke's and Cook County hospitals, where they could be kept under constant observation. In a few cases the rate of improvement seemed more rapid than it would have been by mechanical and surgical measures alone, in the great majority of cases it apparently in no way influenced the progress of the disease, while a few cases seemed to be made worse rather than better.

Since abandoning the opsonic method of giving tuberculin, I have used it after the method suggested by Packard of Denver with more satisfaction. He advocates beginning with small doses, small enough to produce no reaction, and slowly increasing it in those cases which are neither doing well nor hopelessly badly, but those in which

the patient has good resistance but needs a little assistance to tip the scale toward recovery. Even in such cases, the first sign of a reaction is an indication to stop entirely for a while.

*Pott's paraplegia* Paresis or paralysis affecting the lower extremities — the so-called Pott's paraplegia — occurs in about 10 per cent of all cases of tuberculous spondylitis. It may occur early in the disease, especially when the mid-dorsal spine is affected, but as a rule it is a later complication. It is due to an extension of the disease backward into the spinal canal, and pressure upon the cord by the exudate and the pachymeningitis which results. It may present any degree of paralysis, from weakness and inability to control the legs to complete paraplegia, involving the bladder and bowels. Sometimes, especially in dorsal disease, the spastic contractions are so constant and severe as to be very distressing to the patient. If the patient is promptly put to bed, with traction on the head, as described above for the treatment of the pain and muscular spasm, and kept continually in bed long enough, the paralysis usually disappears. It requires from six to eighteen months usually, but I have never seen a case in which recovery from the paralysis has not occurred where the treatment was kept up for sufficient length of time.

I shall dismiss the X-ray treatment of tuberculous joints by saying that, personally, I have never seen any benefit from it nor have I known anyone who has. During the early enthusiasm over the X-rays, many cases were reported of improvement and cure, but I tried it conscientiously in quite a number of cases without seeing any improvement, and gave it up.

## BOOK REVIEWS

CHIRURGISCHE OPERATIONSLEHRE Edited by August Bier, Heinrich Braun, and Hermann Kummell Leipzig: Johann Ambrosius Barth, 1912

The appearance of any system of surgery under the editorship of Bier, Braun and Kummell is of sufficient importance to attract more than passing mention. Anyone, however, who has an opportunity to examine it finds that the subject-matter far surpasses in importance and value what is ordinarily found in such books, and that it combines the good qualities found in the finest type of German text-books with the clearness and conciseness characteristic of the American surgical productions, and he realizes that this work now appearing marks an epoch in surgical book making.

Volume II which is now appearing contains Operations upon the Breasts, by Kuttner, General Technique of Abdominal Operations, by Bier, Surgery of the Stomach, by Bier, Surgery of the Intestines, by Schmieden, Operative Treatment of Appendicitis and Peritonitis, by Sprengel, Operations upon the Liver, Gall-Bladder, Pancreas and Spleen by Korte, and Hernia, by Sudeck. Each of these chapters is a real masterpiece, and the volume should be in the library of every surgeon who reads German.

Kuttner treats of his method of operating upon the carcinomatous breast with extension above the clavicle, and while he has not had particularly successful results, he has found that by following this up by X-ray treatment he is able to prolong the lives of his patients. Especially to be commended is his section which deals with the advances in surgery of the thorax, in which he discusses completely operations upon the lungs which have been made possible by the writer's investigations, and those of Sauerbruch, Meyer, Meltzer, Brauer, and others. The discussion of Fromme's operation is very complete, and he expresses himself as being well satisfied in general with the results.

Kuttner discusses, in addition to the above, the various operations upon the thorax, pleura, lungs, mediastinum, and œsophagus. Each of the 250 pages which he uses in this discussion is worthy of careful reading. They contain many new points and numerous suggestions upon the old ones.

The general technique of Bier is so well known in America that we read with much pleasure and profit the 200 pages in which he discusses the surgery of the stomach, with its relation to gastrostomy and operations upon the pylorus, and the extensive

discussion of carcinoma of the stomach and the treatment of tuberculosis and syphilis.

Schmieden's chapter upon the operations on the intestines, while a complete résumé of the subject and thoroughly satisfactory from the reading standpoint, misses somewhat the personal equation which has made the other chapters of this volume so interesting and valuable.

Korte has been so long connected with the subject of gall bladder that the student reads this chapter with special interest. In it are discussed operations upon the liver, tumors, cirrhosis, and the operative technique of gall-bladder surgery, as well as that of the spleen and retroperitoneal space. This discussion of Korte's is especially valuable because one feels that the observations and suggestions made by him are based upon sound pathology and long experience. It is slightly more abbreviated than the chapters by Kuttner and Bier, but still extremely valuable.

Sudeck's article is a complete résumé of the various types of hernias with a clear and concise description of the technique of their cure.

In general this volume of 850 pages is printed upon good paper, with beautiful clear type and illustrations much superior to the average which appear in German text-books on surgery, many are in two colors. One may feel certain that this system will stand for many years as the guide to the highest type of German surgery.

THE SURGERY OF ORAL DISEASES AND MALFORMATIONS, THEIR DIAGNOSIS AND TREATMENT. By George Van Ingen Brown, D. D. S., M. D., C. M. Philadelphia and New York: Lea & Febiger, 1912.

This work fills a place as a text-book and book of reference very much needed both by physicians and dentists. The author has had many years of experience as a teacher and practitioner and therefore is competent to show the relation of cause and effect between general diseases of the nervous system and other organs of the body and the oral cavity and vice versa. The author has entered into the details of many operations upon the mouth tissues, especially those of cleft palate and harelip.

The work as a whole, is by far the best and most comprehensive of any upon the subject and is recommended to the general practitioner and specialist alike.

The typography, printing and binding show the greatest skill and both the author and publishers are to be congratulated upon the production of such a valuable work.

# Clinical Congress of Surgeons of North America

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FOURTH ANNUAL SESSION

CHICAGO

NOVEMBER 10 TO 15, 1913



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CASEY A WOOD

## THE FOURTH SESSION OF THE CLINICAL CONGRESS

THE fourth session of the Clinical Congress of Surgeons of North America will be held in Chicago, November 10 to 15, 1913.

Under the leadership of Dr E Wyllys Andrews, as Chairman, the Committee on Arrangements has organized and selected its committees and sub-committees as given below. Several meetings of the general committee have been held and the enthusiasm of the members argues for a large attendance and a successful meeting.

The general headquarters of the Congress will be at the Hotel LaSalle, where the entire eighteenth and nineteenth floors have been reserved for the main body of the Congress. This affords the use of the large ball-room for the evening meetings, with the large reception room (Red Room) adjoining for registration purposes, and in addition we can utilize the large corridors, with smaller rooms for committee purposes. This will provide an ideal meeting place, away from the noise and confusion of the streets and the lobbies of a large hotel.

As it is confidently expected that the next session of the Congress will attract a larger number of surgeons than have attended any previous

session, it has been decided by the Committee on Arrangements to provide a separate meeting place and headquarters for the Section on Surgery of the Eye, Ear, Nose and Throat. The entire second floor of the Hotel Sherman has been reserved for this purpose. This will afford suitable registration rooms and a place for holding evening meetings for this branch of the Congress.

A canvass of the facilities of the several hospital amphitheatres and other places for giving clinics demonstrates that Chicago has an abundance of room and that more than 2500 surgeons can be comfortably accommodated at all hours of the day. In addition there are accommodations for fully 600 eye, ear, nose and throat surgeons. When the plans are more completely developed it will be found that there are ample accommodations for a very large number of men.

While the hotel accommodations of Chicago are ample, experiences at the New York and Philadelphia sessions demonstrate that it is wise for all those who anticipate attending the Congress to make reservations in advance.

In the April issue we expect to publish a preliminary clinical program

## SURGERY, GYNECOLOGY AND OBSTETRICS

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## CLINICAL CONGRESS REPRESENTATIVES IN OHIO ORGANIZE

At a meeting of the Ohio members of the Clinical Congress of Surgeons of North America held on Tuesday evening of the week of the meeting last November, for the nomination of representatives, the temporary organization became a permanent one. An executive committee was appointed for the purpose of formulating plans for the holding of state meetings, and given power to act. The committee consists of the following members:

Charles Graefe, President, Sandusky; George M. Todt, Secretary, Toledo; George W. Crile, Cleveland; C. A. Hamann, Cleveland; C. A. L. Reed, Cincinnati; Charles Hamilton, Columbus; Ben McClelland, Xenia; L. G. Bowers, Dayton.

The executive committee held a meeting on Saturday evening, February 22, at the residence of Dr. George W. Crile in Cleveland. Dr. Franklin H. Martin, general secretary of the Congress, was present.

Cleveland was chosen as the first meeting place, the dates selected being Monday and Tuesday, March 17 and 18. It was not definitely settled, but the headquarters probably will be at the Statler Hotel. There is to be a local

programme committee appointed consisting of members from the hospital staffs. There will be a fee of two dollars charged. A ticket will be given to each registered member which will admit him to the clinics. To provide against overcrowding some clinics and to help distribute the members there will be special tickets issued for some of the clinics. All of the hospitals will hold both surgical and diagnostic clinics.

The clinics on the first day will be from 10 to 12 o'clock and from 2 to 4 o'clock. At 5 there will be a meeting of the house of representatives to elect representatives and to nominate two candidates for each office to be filled. The general meeting will be held at 8 o'clock in the evening to elect officers, to select a meeting place, etc. After the business meeting there will be two papers read by men of known reputation. The clinics will begin at 8:30 on the second day and continue until 11:30, also there will be clinics from 1:30 to 3.

All physicians are invited to attend. Cleveland surgeons and diagnosticians are going to give their best, which will be a guarantee of quality. Social festivities will be tabooed. It is to be strictly a working association.





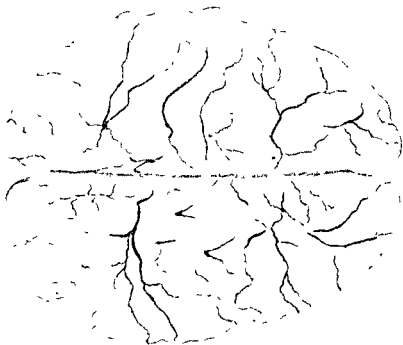


Plate II Streptococcal meningitis. Drainage of the cisterna magna. Later autopsies would indicate that the area within the dotted lines is not influenced by this drainage (Illustrating article on 'Indications for and Results of Operative Treatment of Otitic Meningitis' by Lwing W. Day)

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## THE FŒTAL PERITONEAL FOLDS OF JONNESCO, TREVES, AND REID, AND THEIR PROBABLE RELATIONSHIP TO JACKSON'S MEMBRANE AND LANE'S KINK

By JOSEPH RILUS EASTMAN, M. D., INDIANAPOLIS  
Clinical Professor of Surgery in the Indiana University School of Medicine

IT is the purpose of this paper to call attention to the striking similarity of the foetal peritoneal fold described by Jonnesco and Juvara,<sup>1</sup> and designated by them "the parietocolic fold," to the adult peritoneal anomaly described by Jackson as membranous pericolicitis, and generally known as "Jackson's membrane."

Hofmeister gives credit to Virchow for the first description of this membrane as found in the adult. Binnie, Lane, Hofmeister, Coffey, Connell, Crossen, Flint, C. H. Mayo, Pilcher, Gerster, F. H. Martin and Hall have all contributed to the present knowledge of this matter by reports of cases, many of these having submitted hypotheses to explain the origin of Jackson's membrane. Jackson's early articles were met with hesitating credulity on the part of many who, if they admitted the fact of the existence of these membranes, ascribed their presence to simple inflammation and adhesion formation. Such a view could find very few supporters now.

It is the further purpose of this paper to call attention to the probable causal relationship between the bloodless fold described by Treves<sup>2</sup> and a pocket-like anom-

alous peritoneal reflection, which is not rare in the adult and which passes from the mural peritoneum upon the right side quite low down, extending upward and inward over the caput coli and vermiform appendix, to be attached to the last two or three inches of the ileum and to the peritoneum of the caput coli. It forms the boundary of a precolic fossa in which the caecal head and the appendix may rest as in a pocket. It is likely that the caput coli with the appendix are, not rarely during operations for appendicitis, shelled out of this peritoneal pocket, the peritoneal fold, that is the bloodless fold of Treves, which forms the pocket being looked upon by the operator as an affair of adhesion formation.

Moreover, although conceptions of Lane's ileopelvic band, the structure to which is ascribed an important part in the causation of Lane's kink, are somewhat varying, it may be well in discussing the nature and origin of this band to recall that Douglas Reid, of the University of Cambridge,<sup>3</sup> has described under the name "genito-mesenteric fold" a rather common foetal fold of peritoneum which passes from the terminal portion of the ileum into the pelvis. Concerning this genito-mesenteric fold, which may be found readily in a surprisingly large percentage of

<sup>1</sup> Studies of the Intestine and Peritoneum in the Human Fetus. *J. Anat. & Physiol.* xlv, 75.

<sup>2</sup> Anatomie des ligaments de l'appendice vermiforme et de la fossette iléo-appendiculaire. *Le Progr. Méd.*, xlv, 273.

<sup>3</sup> The Anatomy of the Intestinal Canal and Peritoneum in Man. *Hunterian Lectures*, 1885.

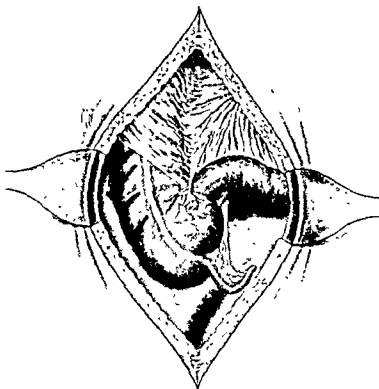


Fig. 1. Parietocolic fold of Jonnesco and Juvara, found in about 20 per cent of fetuses after the sixth month.

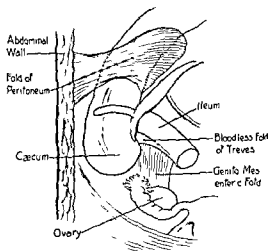


Fig. 2. Diagram after Douglas Reid, showing the parietocolic fold crossing in front of the ascending colon.

fetuses after the seventh month, or even after birth at term, the question may be fairly raised as to whether it is not related to angulations or gravitations or other deformities of the terminal ileum to which it is attached.

The parietocolic fold of Jonnesco and Juvara in most cases arises from the peritoneum at the left or inner side of the ascending colon, passing over the anterior aspect of the ascending colon in an upward slanting direction. It is attached to the parietal peritoneum at the right of the ascending colon. It may adhere to the anterior and lateral aspects of the colon. Reid (*ibid.*) ascribes to this fetal fold practically the same relations as are presented by the parietocolic fold or Jackson's membrane when found in the adult (Figs. 1 and 2).

By courtesy of Dr. H. R. Alburger, pro-

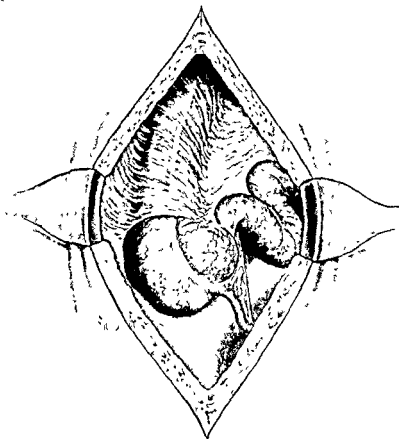


Fig. 3. An extensive parietocolic peritoneal fold constricting the lumen of the ascending colon. Condition found in a fetus seven months old.

fessor of pathology in the Indiana University School of Medicine, 28 fetuses were examined in the course of preparation of this paper. All of these had passed the sixth month, and varied in length from 12 to 32 cm. In the series of 28 fetuses, 5 presented the parietocolic fold. Reid found it present in 3 out of a series of 20 fetuses, or in about 15 per cent of the fetuses examined. In a fetus 20 cm. in length, I found a parietocolic fold which enveloped the ascending colon in such a manner as to constrict it to less than one half the transverse diameter of the caput coli which bulged forward, balloon-like, below the grasp of the encircling peritoneal fold (Fig. 3). Observing that the blood-vessels of the parietocolic

membrane continued over on the mural peritoneum, it was recalled that Hall, in his report of an examination of one of Jackson's first cases of membranous pericolicitis in the adult, noted also that the blood-vessels of the parietal serosa were continuous with those of the anomalous membrane which enveloped the ascending colon.

In a fetus at term (Fig. 4), a parietocolic membrane was found which began at the inner side of the ascending colon and passed around to the front of the colon, where it branched, the larger leaf passing downward, spreading web-like along the colon and spanning the concavity of an elbow-bend in the colon, the sharp free edge of the membrane being upon the inner or left side. It was

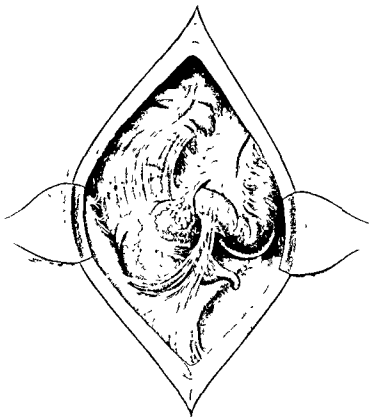


Fig. 4. An unusual form of parietocolic fold of Jönnesco and Juvara above. The bloodless fold of Treves shown below appeared in the same specimen, a fetus at term.

suspected that the flexure of the colon referred to was due to the presence of the membrane which passed from one limb of the elbow to the other. The bloodless fold of Treves was also present in this case.

In a fetus 22 cm. in length (Fig. 5), a web-like peritoneal covering was found upon the ascending colon, which passed over upon and was continuous with the serosa covering the great omentum. This membrane was closely adherent to the serous covering of the ascending colon, as if the layers had become fused together.

In a fetus 17 cm. in length, Reid found the posterior (direct) and the anterior (reflected) laminae of the great omentum firmly adherent, and the posterior (direct) lamina fused

completely to the colon. In the first case of so-called "membranous pericolicitis" in the adult which I operated upon, the web-like anomalous peritoneal membrane fused with the serosa of the ascending colon, as described above. The veil-like membrane could not be removed without taking with it the normal peritoneal covering of the colon, thus leaving the latter raw and bleeding. In this case the web-like peritoneal membrane passed over on the gastrocolic omentum (Fig. 6). Whether this was a case of actual fusion of the two peritoneal layers of the omentum with the peritoneal surface of the colon was not proven. This was owing to the circumstance that the author was not aware at that time of the fact of the occasional

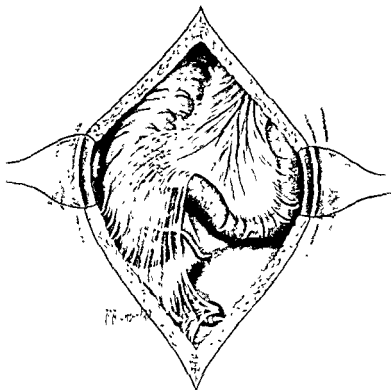


Fig 5 Extensive bloodless fold of Treves passing over cæcum to mesocæcum, the inner border of the fold connecting the terminal ileum with the genital gland

existence of such a relationship Flint<sup>1</sup> states that "when the rotation of the gut is complete the mesogastrium balloons forward and the formation of the great omentum begins. This fuses later with the transverse colon and the gastrocolic omentum thus comes into existence. Usually this fusion takes place only along the transverse colon, establishing the usual relationships. Not infrequently the omentum attachments extend farther to the right, even to the abdominal parietes." Thus it will be seen how the two peritoneal layers of the great omentum unseparated by fat may come to lie upon the serosa of the ascending colon as well as upon the transverse colon.

To return to the parietocolic peritoneal fold of Jonnesco and Juvara. This membrane, in the five cases observed, could readily be separated from the underlying colic peri-

toneum. This is true of many cases of Jackson's membrane, and this would hardly be the case were it a product of membranous pericolicitis alone, as suggested by Jackson, or of mechanical irritation alone, as indicated by Martin. Concerning the origin of Jonnesco's fold, we have found several succeeding stages of its formation which indicate that adhesions may form between the serosa of the cæcum and the mural serosa while the cæcum is still subhepatic. The subsequent descent, with torsion or rolling inward upon the long axis, draws the parietal serosa over in front of the ascending colon in a slanting or spiral direction, like a ribbon wound spirally around a rolling cylinder.

In 28 fetuses examined, the bloodless fold of Treves was found 9 times (Figs. 7 and 8). It passed from the lateral posterior parietal peritoneum to the terminal part of the ileum

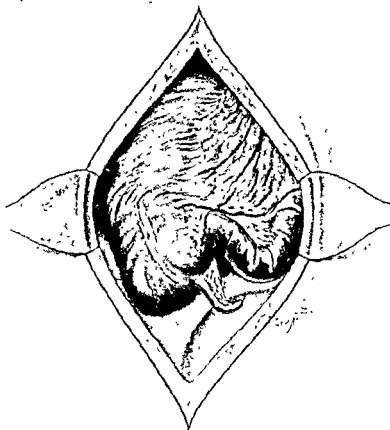


Fig 6 Anomalous peritoneal covering of the ascending colon formed by fusion of the normal peritoneum of the colon with the anterior and posterior lamina of the great omentum

and the caput coli, fusing with the peritoneum covering the intestine. It was always more or less fan-shaped, the broad attachment being to the mural peritoneum. The intestinal end was always the more narrow. It formed a pocket in which the vermiform appendix and more or less of the caput coli and cæcum were enclosed. This fold is described by Douglas Reid as follows: "Passing from the mesenteric border of the appendicular cæcum and from the non-mesenteric border of the last part of the ileum to the posterior and lateral abdominal wall is a sheet of the peritoneum. This forms the anterior wall of a fossa completely closed save below. Its orifice is bounded in front by the free lower edge of the peri-

toneal sheet, medially by the ileum and the adhesions which bind this down, and posteriorly and laterally by the parietal peritoneum."

It will be seen from Fig 9 taken from Reid, that the bloodless fold of Treves may adhere to the abdominal wall and resist for a time the completion of cæcal torsion. It does not seem illogical to assume also therefore, that the lower inner border of the bloodless fold of Treves may resist the drawing upward and inward of the last part of the ileum, thus preparing conditions favorable to the formation of Lane's kink, or actually causing it. Keeping in mind the attachments of the bloodless fold of Treves before cæcal torsion or internal rolling upon the long

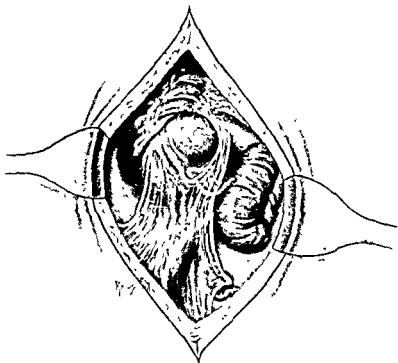


Fig 7 The bloodless fold of Treves The inner border passed from the terminal ileum to the genital gland, corresponding in its position to Reid's genito-mesenteric fold and Lane's ileopelvic band as seen in the adult

axis has taken place it is not difficult to understand how the cæcum covers itself as it turns over with this sheet of peritoneum, just as a man rolls himself up in a blanket.

In Huntington's "Anatomy of the Peritoneum" (p 241) will be found a description of cæcal torsion. "When the cæcum has come down from its hepatic position, the terminal coils of the ileum pass from right to left behind the cæcum to enter the colon, and the concavity of the cæcal pouch is directed upwards and to the right. After the final act of rotation has occurred, that is, after the cæcal torsion has taken place, the ileum enters the large intestine from the left and from below, and the concave border of the cæcum is directed to the left. This change in relative position has been accomplished

by a revolution of the colon and cæcum through an arc of  $180^{\circ}$  around its own long axis, carrying the cæcum above and behind the small intestine and bringing it into contact with the dorsal prerenal parietal peritoneum. At the same time the terminal coils of the ileum turn downward and to the left. If this final step in the rotation of the large intestine fails to occur, with other wise normal development of the parts, the ileum will persist in entering the large intestine from right to left after the cæcum has obtained its final lodgment in the right iliac fossa."

Reid speaks of two cases in which the parietocolic fold is formed by a large appendix epiploica. The presence of the parietocolic fold and of the bloodless fold of





Fig. 8. A broad fan-shaped bloodless fold of Treves covering a loop of the ileum.

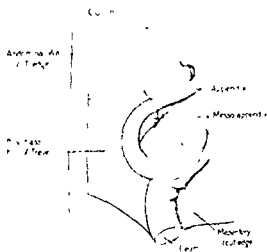


Fig. 9. Diagram after Douglas Reid showing the attachments of the bloodless fold of Treves and the possibility of this fold resisting caecal torsion.

Treves might be explained by assuming that before caecal torsion takes place a large appendix epiploica or several appendices epiploicae become adherent to the parietal peritoneum and elongate and spread out as the colon rolls over from right to left. It is difficult to understand how an adhesion between the colon and the mural peritoneum could occur except through an appendix epiploica, inasmuch as before caecal torsion is complete the colon and mural peritoneum are separated by coils of intestine which lie in front of the colon below that part which is covered in front by the liver. At the right side lies the appendix, which, it should be noted, is proportionately very large in the fetus. It forms a loop at the side of the colon and caecum. The appendix with the meso-appendix completely separates the colon from the peritoneum at the right lateral abdominal wall. Reid remarks that at this stage of caecal torsion it appears to be

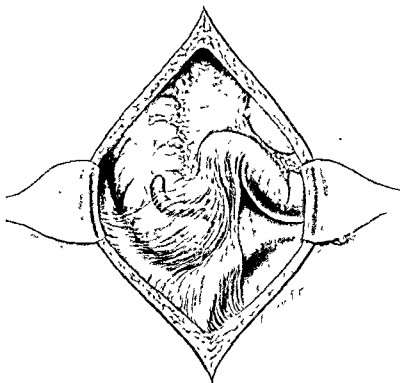


Fig. 10. A broad bloodless fold of Treves forming a pocket in which are ensconced the caput coli and appendix

impossible for any adhesion to form between the colon and the lateral abdominal wall excepting through the medium of an appendix epiploica. Contemplation of an appendix epiploica in the adult would certainly furnish an erroneous conception of the length and width of the foetal folds here considered. Reid's remarks concerning the possible rôle of appendices epiploicae in the formation of these folds take the form of intimations only. He does not leave the impression that he would claim to have cleared up this somewhat obscure matter.

Whatever the origin of these folds in the foetus, there will be no doubt in the mind of anyone who will examine the region of the cæcum in a few foetuses that they exist before birth and are readily demonstrable in one form or other in approximately 20 per cent of foetuses after the sixth month. The fold of Treves was present in a larger percentage of cases.

If we admit that the bloodless fold of Treves is a reality, and that there is no error as to its being attached, as described, to the ileum and cæcum, and if we admit that cæcal torsion after such attachment is a fact, then there should be no surprise, in view of the frequency of the appearance of Treves' fold in the foetus, that occasionally we find the caput coli in a peritoneal pocket in the adult. I have shelled the caput coli and appendix out of this pocket in operations for so-called appendicitis several times (Figs. 10 and 11). The caput coli does not fit loosely into the pocket. There seems usually to have been a more or less successful attempt at fusion of the bloodless fold of Treves with the caput coli and appendix, so that it is necessary to dissect out bluntly the appendix and cæcal head, chiefly with a Mayo's blunt scissors.

Jackson's membrane is as yet indefinitely described. Its location is not constant

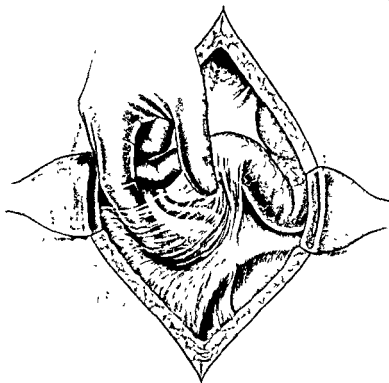


Fig. 11 Shelling the caput coli and appendix from a pocket formed by a persisting bloodless fold of Treves

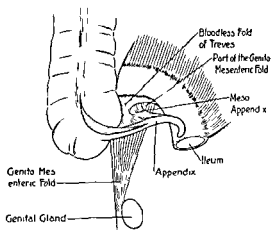


Fig. 12 Diagram after Reid, showing the genito-mesenteric fold

Without doubt membranes have been designated "Jackson's membrane" which Jackson would not have embraced under the name "membranous pericolicitis." However, I know that some of my colleagues have looked upon as a Jackson's membrane what was, in view of evidence now at hand, certainly a persisting bloodless fold of Treves, which held the caput coli and appendix as in a pocket of a shirt. I have found the bloodless fold of Treves to be present, not only in cases presenting, generally speaking, the symptoms of chronic appendicitis, but in two instances in the course of operations which did not concern the intestine at all. In both of these cases the last part of the ileum was drawn downward in a slight degree. But the persisting foetal fold was lax, and there had been no symptoms of Lane's kink.

The fold which was described by Douglas

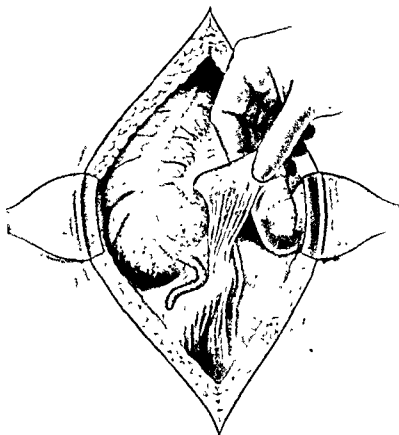


Fig 13. Shows the genito-mesenteric fold of Reid as it was observed in an adult during an operation for a pelvic lesion upon the opposite side. This persisting foetal fold which produced no symptoms is perhaps what Lane has called the ileopelvic band.

Reid and called by him "the genito-mesenteric fold" passes from the mesentery of the last part of the ileum down into the pelvis, being attached in the foetus to the genital gland below (Fig 12). It will be seen, therefore, that it has a secondary connection with the ileum and, through the peritoneum of the meso-appendix with the appendix itself, a connection which perhaps is responsible for the frequent association of appendicitis and oophoritis (Reid). I have seen this fold in the adult (Fig 13). By lifting the last part of the ileum upward, a thin fold of peritoneum which was quite loose could readily be seen passing from the mesentery of the

last part of the ileum over the brim of the pelvis, to the region of the ovary. There was no sharp border of this fold upon the right side. It spread out on the right into a rather narrow fold of Treves. Reid describes this genito-mesenteric fold as passing under the appendix, whereas the fold of Treves passes over the caput coli and appendix. However, in our cases, the inner or left border of the bloodless fold of Treves has ended in each case below in the genital gland in the foetus, at the ovary in the female after birth, and at the intra-abdominal ring in the male at term. Perhaps we have not seen the genito-mesenteric fold as it was seen by Reid



Fig. 14 After C. H. Mayo, showing Lane's ileopelvic band in the adult. Note the resemblance between this Lane's band and the fetal fold of Douglas Reid shown in Fig. 13.

Certainly we have not seen it as a separate distinct fold, but rather as the inner prominent edge of the bloodless fold of Treves, passing from the terminal ileum to the genital gland. It is this genito-mesenteric fold of Reid, or the prominent inner border of the fold of Treves, as the case may be, which corresponds in its position and attachments to the ileopelvic band of Lane. The relationship between the fetal fold and Lane's band is, perhaps, only suppositional but it seems not unlikely that they are identical (Fig. 14).

Reid has further drawn attention to adhesions of the colon to the peritoneum of its own mesentery. I have seen in operations upon the adult the peritoneum of the mesentery of the ascending colon reflected upward and adherent to the colonic peritoneum for a distance of five inches. Byron Robinson noted this form of adhesion.<sup>1</sup> I have observed it twice in the adult (Fig. 15), it was unassociated with evidences of inflammation. As it was seen by Reid in the foetus it is fair to suspect this reflection of the mesenteric peritoneum of being a persisting fetal adhesion. We have here strong presumptive evidence that Jonnesco's fold is due to adhesion, with subsequent rolling inward or normal caecal torsion.

Concerning the relationship of the folds of Treves and Jonnesco to Jackson's membrane, it may safely be stated that not all anomalous



Fig. 15 Adhesion of the peritoneum of the ascending colon to the peritoneum of its own mesentery. This suggests an adhesion before caecal torsion took place. Subsequently, as the caecum rolled over, the peritoneum of the mesocolon was pulled up.

membranes which have been designated as Jackson's membrane are persisting fetal folds as described above. The explanation which C. H. Mayo gives of the origin of Jackson's membrane, which is, in effect, that after the peritoneum has formed, the rotating caecum, coming down from its subhepatic position, pushes ahead of it an extra covering of peritoneum, is about the only hypothesis by which we can explain that form of Jackson's membrane which encloses the caecum and ascending colon as in a bag. Mayo's explanation has been corroborated by those who have made studies of the peritoneum in the foetus, the differences in conclusions being largely differences of language. Mayo spoke of "burrowing of the caecal head" under mural serosa as it descended and rolled inward, whereas adhesion formation while the caecum is subhepatic with subsequent descent and internal torsion seems best to describe our impressions. However, fetal peritoneal reflections, folds and adhesions

are so numerous and varying that it requires no great stretch of imagination to think of the descending cæcal head catching under loose reflections, and actually burrowing under them, as suggested by Mayo, after the manner of a descending hernia.

The principle of mechanical irritation, the result of visceral gravitations, to which F. H. Martin ascribed a part in the production of membranous pericolicitis, is, without much doubt, an important associated factor. Pilcher's view, which considers it the result of long continued and oft-repeated mild infections of the peritoneal coverings of the cæcum and appendix transmitted through the intestinal wall, and that of Gerster, which attributes the membrane to peritoneal reaction to infectious processes associated with chronic colitis, fit in well with the ex-

planation of the embryonal origin of these membranes presented by Flint (*ibid.*), since their fusions, adhesions and contractures are doubtless directly or indirectly due to inflammation. It is highly probable that mechanical irritation and inflammation are important immediate or exciting causes of the clinical states embraced under the terms "membranous pericolicitis" and "Lane's kink." The final solution of the problem of the origin of Lane's kink and Jackson's membrane will in our judgment, be represented by the sum of the views of Flint, C. H. Mayo, Lane, Jackson, Connell, Pilcher, Coffey, Binnie, Gerster, and Martin.

In the meantime however, much information of value can be gained by a study of the fetal peritoneal folds of Jonnesco, Treves, and Reid.

## ETIOLOGY OF LANE'S KINK, JACKSON'S MEMBRANE, AND CÆCUM MOBILE<sup>1</sup>

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THE general acceptance as clinical entities of the above enumerated conditions has led to much speculation and theorizing as to the etiological factors that may produce such results. These explanations may be roughly divided into inflammatory and non-inflammatory, differentiation between them may at times be difficult because of the fact, which has not been sufficiently emphasized, that inflammatory reaction occurring either as a result or as an independent coincident may leave resultant adhesions that might confuse the question of etiology.

I will confine my remarks to a consideration of the non-inflammatory factors, which offer a rational explanation for typical examples and may be either acquired or congenital. The acquired is best exemplified by the theory of Lane (1) that these bands are crystallizations of lines of force in Nature's attempt to correct ptosis of the colon.

A combination of both the congenital and acquired factors is presented by Martin (2), who calls attention to the long continued traumatism of the comparatively fixed portion of the terminal ileum by the overriding of the abnormally movable colon and other superimposed viscera. The congenital theory suggested by Mayo (3), that the cæcum descends behind the posterior parietal peritoneum instead of in front, has not met with general acceptance.

The following explanation, based upon the theory of imperfect development, I first presented before the Chicago Gynecological Society on February 23, 1912 (4). Since then observation of cases of this character has given considerable support to this theory, as have likewise the publications of J. M. Flint (5) and Gray and Anderson (6).

In order to understand the probable developmental faults leading to these conditions it will be necessary to review the normal de-

<sup>1</sup> Read before the Western Surgical Association, Cincinnati, Ohio, December, 1919.

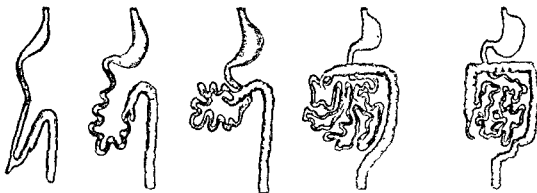


Fig 1

Fig 2

Fig 3

Fig 4

Fig 5

Migration and rotation of cæcum in normal development

velopment (Figs. 1-5, from Huntington), during which the ileo-cæcal junction migrates from below upward and to the left to form the splenic flexure, crosses the abdomen to the hepatic flexure, where it rotates on its long axis, descends, and is fixed in its normal, i. e. usual, location in the right iliac fossa.

In the available literature this most complicated embryological maneuver is spoken of under the caption "Rotation of the Cæcum," and it is in a large measure due to this use of a single term to describe these

various changes that there has arisen considerable confusion regarding this matter. On closer analysis one finds that this so-called rotation is comprised of three definite and distinctly different elements, viz., migration, rotation, and fixation.

By migration will be meant the journey of the ileo-cæcal junction up, across and down the right side of the abdominal cavity (Figs. 1-5).

The term rotation will be confined to the actual axial rotation of the ileo cæcal junc-

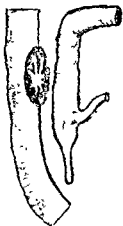


Fig 6.



Fig 7

Relations before fixation of ascending colon

tion through an angle of 180 degrees in a direction from above downward, backward, and forward (Figs. 3 and 4).

By fixation is meant the blending or fusion of the posterior layer of the visceral peritoneum of the colon and the primitive mesocolon with the prerenal primitive parietal peritoneum, by means of which the advantages gained by the migration and the rotation are retained, and the ileo cæcal junction is held in its normal and desirable location in the right iliac fossa (Figs. 6 and 7, before fixation, Figs. 8 and 9, after fixation).

We have here reviewed the usual, the natural or normal development of the ileo cæcal junction, and are now ready to consider its possible anomalies.

#### ANOMALIES OF MIGRATION

Migration may be (a) incomplete or (b) delayed.

(a) *Incomplete migration* With arrest of migration in its transit across the abdomen there will be an absence of an ascending colon and an incomplete transverse colon. This may occur at the hepatic flexure either before or after its fixation (Figs. 3 and 4). If before fixation, the ileo-cæcal junction may fall back to the left iliac fossa (Fig. 10). This condition is unusual, but will account for some of the authentic cases of left-sided appendicitis

in which the viscera are not transposed. After fixation, the transverse colon will be complete, but there will be an absence of the ascending colon. Such cases are not uncommon, I have met with one (Fig. 11), and Mayo (8), Flint (9) and others report similar conditions.

The commonest arrest of migration occurs at any point between the hepatic flexure and the so-called normal location in the right iliac fossa (Figs. 4 and 5).

(b) *Delayed migration* The cæcum may be in its usual location, descent having been complete, yet there may be evidence in support of the supposition that such descent has been delayed. The evidence will consist of adventitious bands or membranes extending from the prerenal parietal peritoneum downward and forward to the anterior surface of the colon i. e. a pericolic membrane, being probably the expanded or stretched line of primary fusion which had taken place while the colon was still in an undescended or subhepatic position. Fig. 12 shows the formation of a membrane in such a manner and is taken from the most instructive monograph of Flint (5).

#### ANOMALIES OF ROTATION

These may be (a) non-rotation, (b) excessive rotation, or (c) reversed rotation.

(a) *Non-rotation* is most common with in-

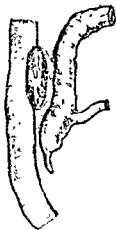


Fig. 8  
Relations after fixation of the ascending colon.



Fig. 9



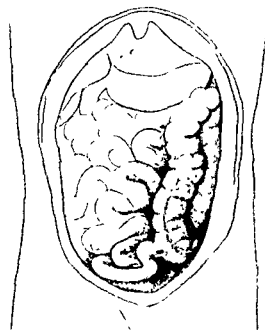


Fig. 10 Arrest of migration before rotation or development of hepatic flexure with absence of transverse and ascending colon

complete migration before the development of the hepatic flexure (Fig. 10). It may likewise, but less frequently, persist after the formation of the hepatic flexure and the ascending colon. In such instances the terminal ileum enters the caecum from behind or from the lateral or right side instead of from the median or left aspect of the caecum, and may lie in contact with parietal peritoneum and fuse in such relationship as to cause subsequent obstruction the Lane kink. Huntington (7) and Kelly (10) each report cases of this type. Stewart (11) mentions two, and personally I have encountered this anomaly twice (Fig. 13), in both of which there was a Lane kink with caecum mobile.

(b) *Excessive rotation*, that is rotation in a normal direction but of more than 180 degrees, even as much as 270 degrees, results in the ileum entering the caecum from before backward, instead of from the left or median aspect as is usual. Fusion between such apposed visceral and parietal peritoneal coats



Fig. 11 Arrest of migration after rotation and development of hepatic flexure with absence of ascending colon

will result in fixation of the colon and terminal ileum in abnormal positions (Fig. 14).

Such a condition will probably persist until the bowel functionates and the erect posture is assured then as the caecum and the terminal ileum contain contents which allow gravity to exert a pull the tendency will

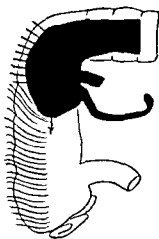


Fig. 12 Showing development of pericolic membrane (Tint)

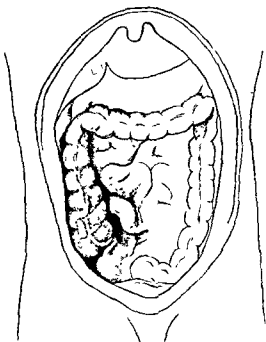


Fig. 13 Non rotation with complete migration

be for the ileo-cæcal junction to return from its exaggerated rotation and assume its normal

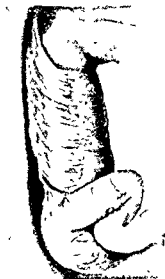


Fig. 14 Normal migration, with excessive rotation and fixation

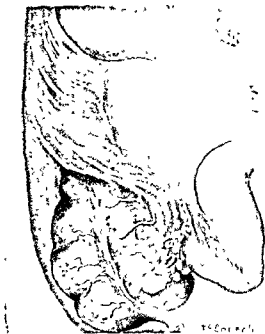


Fig. 15 Exaggerated rotation of Fig. 14, corrected by return to normal rotation

relations (Fig. 15). By so doing the lines of serous fusion previously formed will stretch and form a membrane or veil on the colon that will accurately fulfill the detailed description of the pericolic or Jackson membrane, and the fixation of the terminal ileum that will simulate the Lane kink.

(c) *Reversed rotation* in which rotation takes place from above forward and downward instead of from above backward and downward, would result in a kink at the hepatic flexure, a kink in the terminal ileum, and in the ileo-cæcal junction and the appendix becoming entangled in the primary mesentery in such a manner as to readily suggest the Jackson membrane, the Lane kink, or structures that might be called "adhesions." That a reversed rotation might occasionally take place seems quite plausible, for as Huntington says "The apex of the cæcum is frequently embedded among these terminal coils of the ileum," yet in the examination of a large number of ileo-cæcal junctions in which one or more of these conditions were present, I have been unable to find satis-

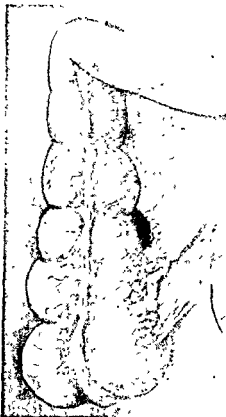


Fig. 16 Absence of fixation—'caecum mobile'

factory evidence of any such reversed rotation having taken place

#### ANOMALIES OF FIXATION

(a) *Absence*, complete or partial, (b) *early* (c) *of improper surfaces*

(a) *Complete absence* of fusion between the parietal and visceral peritoneum of the ascending colon and mesocolon will result in the so-called caecum mobile (Fig 16). This is quite common and may be accounted for by late rotation in which coils of ileum prevented the apposition of the surfaces that usually fuse. With incomplete absence, such as normal fusion of the upper third and absence below, the mobility will be less marked, if present in the upper two thirds and lacking in only the lower third, the result will be approximately normal. Fusion of the lower portion of the colon, with absence at



Fig. 17 Partial fixation—'double-barrel' colon

the upper part may result in an angulation and in marked cases will show the characteristic 'double-barreled colon,' of which I have met with three typical examples (Fig 17)

In such cases adventitious ligaments, bands, or membranes are often seen, which may be belated, ineffectual attempts on the part of nature to hold the viscera in its proper position, or may be due to secondary changes due to the stasis caused by the angulation

(b) *Early fixation* before the complete descent of the ileo-caecal junction, has been considered in the discussion of delayed migration

(c) *Fixation of improper surfaces*, of normal and of excessive rotation, have been considered in the discussion of delayed migration. But even with normal migration and rotation, the usual fusion which ceases at the lower margin of the ascending mesocolon may become excessive and with either normal or defective fusion above this point, extend a greater or less length along the terminal ileum, causing a condition necessary for the development of the so-called Lane kink.

The theory of Gray and Anderson and of J M Flint, that the Jackson membrane is the right margin of the great omentum, which during development becomes adherent to the dorsal parietal peritoneum opposite the flexure and along the outer side of the ascending colon for a varying distance, is another example of fusion of improper surfaces. Subsequent descent of the caecum may give to this portion of the omentum the characteristics of the pericolic membrane, and seems to be a very rational explanation, and without doubt this is what takes place in certain of these cases. As to the primary cause or causes of these various abnormal or defective developments (that is, in cases of abnormalities such as atrophy of the bladder, cleft palate, lack of fusion of the funicular process in hernia etc.) we are, as yet, entirely ignorant, but a definite understanding as to whether these conditions are due to inflammatory or developmental factors is of the utmost importance from the standpoint of proper and rational treatment.

#### CONCLUSIONS

1 Anomalous development offers a rational explanation for these conditions

2 Coincident or resultant inflammation may cause confusion

3. Describing the embryological changes in the ileo-caecal region under the single term "rotation" likewise causes confusion.

4 Such changes are migration, rotation, and fixation, one or more of which may be imperfect

5 The Jackson or pericolic membrane may be due to excessive rotation delayed migration or early or anomalous fixation

6 The Lane kink may be due to excessive or anomalous fixation

7 The caecum mobile is due to an absence of fixation

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## BILOCULAR HERNIA

By V L SCHRAGER M D, CHICAGO

IN operating upon inguinal or femoral hernias one occasionally encounters more than one sac on the same side. Such was the case in two patients operated upon by Dr D D Lewis, in his clinic at the Presbyterian Hospital. The purpose of this paper is to bring forth a new theory as to the mechanism of the double sac. A search through the literature has not revealed a single case in which the pathogenesis of the double sac was similar to that of Dr Lewis' case.

By bilocular or multilocular hernial sacs we understand the presence of two or more sacs

in the same inguinal or femoral hernia, the pouches communicating with one another. Properly speaking, a double sac is merely a division of one sac. As B Schmidt<sup>2</sup> puts it, there are no double or multiple sacs, just as there is no absence of sac, occasionally alluded to. Sacs made up of several concentric layers like the leaves of an onion, were described by several of the older writers. Dieffenbach, Gunther, and Pitha, among others, described sacs with eight or ten concentric layers. This type of sac is not included in our description. Considering the complex terminology given

<sup>2</sup>Deutsche Zeitschr. f. Chir., xlviii, p. 129

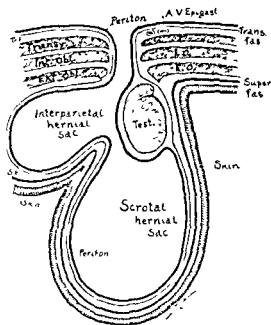


FIG. 1

some malformation. Fig. 2 shows, in a schematic manner, the mechanism of the usual type of bilocularulation, one sac being in the scrotum, while the other is forced laterally, being blocked by an undescended testicle

#### HISTORY OF OUR CASES

G. K. Greek, age 42. Admitted to the Presbyterian Hospital January 13, 1911, discharged January 26, 1911. Four months prior to his admission to the hospital he jumped from a wagon. Two days later he noticed a swelling in the right groin. Wore a truss since. Had, at times, some discomfort but no appreciable pain. Operated by Dr. D. D. Lewis. The usual hernia incision was made. After incising the fascia of the external oblique, a sac of a direct type was detected. It was freed as far as possible toward the abdomen and then opened. It contained a piece of fat. The sac was transfixed and tied off. A second sac also of a direct type, was found medially to the first one. This was also freed, opened and transfixed. It also contained fat. The sac was intimately adherent to the bladder. The two sacs were of equal length, hourglass in shape and about three and one half inches each in length. The hourglass saccululation was due to a division of the original sac by a strongly developed Hesselbach ligament as shown in Fig. 2. The repair was made

to double sac hernias, one is tempted to accept the suggestion made by Moynihan<sup>1</sup> in 1900:

I think that all these forms of hernias might with advantage be included under the title bilocular hernias. A bilocular sac is made of two communicating pouches. One is situated in the inguinal, occasionally in the femoral canal while the other protrudes either between the transversalis fascia and peritoneum (properitoneal hernia) or between the layers of the abdominal wall (interstitial hernia) or it may be located between the skin and the fascia of the external oblique (inguino-superficial hernia). All of these types of bilocular hernias could be well covered by the term interparietal hernias. They have a great many features in common and though described separately could be embraced in a general description. Most interparietal hernias are right-sided because the vaginal process remains more frequently patent and the testicle descends later on that side. In a large majority of such hernias, the testicle is either undescended or shows evidence of

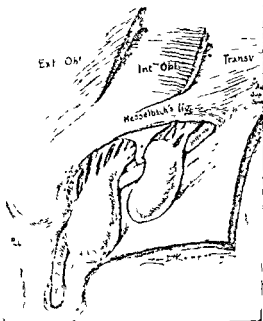


Fig. 2. Biloculation of a hernial sac by a strongly developed Hesselbach's ligament.

according to Bassini and the fistula was imbricated by the Andrews method. The patient made an uneventful recovery, the wound healing by primary intention.

**Brief anatomy of Hesselbach's ligament.** The conjoined tendon of the external oblique and transversalis is attached to the crest of the pubis and to the pectineal line. It is sometimes divided into an outer (Hesselbach's ligament) and an inner portion (Henle's ligament). The former is situated on the posterior wall of the inguinal canal and in front of the deep epigastric artery (Fig. 3). A hernial sac may be hooked by a strongly developed Hesselbach's ligament as it emerges from the inguinal canal thus producing a bilocular sac.

The second history is that of a case of double hernial sac in which however Hesselbach's ligament was not the cause of bilocularization.

G. M. Greek laborer. Admitted to the Presbyterian Hospital July 24, 1910. Four years previous to the date of admission while lifting a very heavy

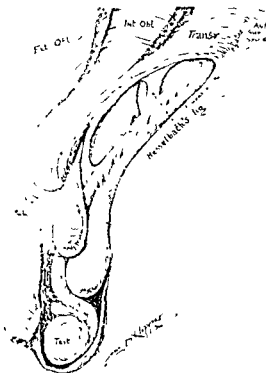


Fig. 4. Double hernial sac.

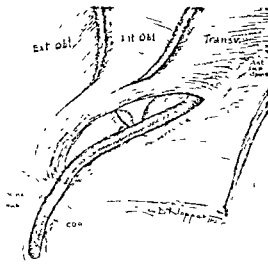


Fig. 3. Showing Hesselbach's ligament.

stone he experienced some pain in the right inguinal region and soon after discovered a slight swelling in the same region. It remained small for three years but increased rapidly in the last year. His general health was good during that period. A general routine examination revealed nothing pathological. The right inguinal area was represented by a large tumefaction which descended into the scrotum. It had all the physical earmarks of a hernia. The inguinal ring was very large. The entire mass was readily reducible. The left inguinal region contained a swelling that increased on cough and was also a hernia. The patient was operated upon by Dr. D. D. Lewis. The hernia was exposed by the usual incision. There was a very large sac of a direct type surrounded by very dense bands of connective tissue. There was another sac of an indirect type in close connection with the first (Fig. 4). Both sacs were isolated transfixed and ligated dropping the stumps back. The repair was made according to the Bassini method. Both incisions healed by primary intention.

CHORIO-EPITHELIOMA<sup>1</sup>

RECURRENT AFTER THREE YEARS, INVASION OF THE SPINAL CANAL; VILLI IN SECONDARY GROWTH

By EUGENE CARY, S. B., M. D., CHICAGO

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**T**HIS report is not intended to merely add another to the rapidly growing literature on the subject, but rather to try and emphasize the exceptional features in the case. Over 300 cases have been reported, and so far as I have been able to learn from the summaries made, some of the conditions I have studied have not been described.

*Clinical history*—Mrs. M. M., 37 years old, miscarried early in February of 1907 and for the following four to six weeks suffered general debility and had three or four severe uterine hemorrhages, for which she was curetted twice, unfortunately the scrapings were not examined microscopically. A month later a brownish discharge developed that stopped of its own accord. A little later she "caught cold" and had pains all over the abdomen which finally located in the uterus, the week following a palpable tumor developed in the left side and an operation was advised. She entered the Presbyterian Hospital in the service of Dr. J. Clarence Webster on June 12, 1907, complaining of pain in the lower abdomen and pelvis, tenderness in the left lower quadrant, and intermittent uterine hemorrhages for the past four months following an abortion. This miscarriage took place about six weeks after gestation began. She stated that after two days of pain the fetus came away but that the placenta remained.

Her menstruation was established at eleven years, which was of the regular 28-day type, with moderate flow lasting three to four days, without pain. The last period was in December. She was married at 25 and had been pregnant five times. All the other pregnancies went to term. The first child was delivered with forceps and the puerperium was normal. She never nursed her children.

The operation was a panhysterectomy.

*Condition of the abdomen and pelvic contents on operation*—The uterus is considerably enlarged, being 12 cm. in depth. There is a mass 8 cm. in diameter on the left side extending into the broad ligament and consisting of a mass of hydatid-like sacs. There is extensive vascularity and thickening of the broad ligament on the left side. All parts are vascular and bleed profusely. The tumor is ruptured and bleeds from its surface. The growth extends into the thickened left ovarian veins and the latter were removed as high up as possible. The ovaries are

shrunken and firm, the tubes short, being 7 cm. long.

The recovery was uneventful, and the patient was discharged from the hospital in good condition.

The admission the second time was to Dr. James B. Herrick's service in the same hospital on June 25, 1910, three years following the previous admission. She was then complaining of backache, aching in the hips and abdomen, and chronic constipation.

The previous February she had an attack of the "grippe," when the pain began in the right hip, spread to the back and other hip, and radiated down into the groin. This was intensified on moving about and has been constant ever since. She also had pneumonia during the preceding autumn.

From entrance, June 25, to July 3 the patient complained bitterly of the pain in the back and legs which was not relieved by opiates. She was very restless and slept but little. On July 5th she coughed occasionally raising a small quantity of bright red blood. Next day she had retention of urine. Numbness and tingling of the feet without the ability to stand developed, and she became almost helpless, crying aloud with pain. On July 9th and 10th she complained of pain only when her head was raised and then only in the back. Involuntary defecation appeared and retention of urine persisted. On the 11th she had a feeling of fullness in her chest and her respirations rose to 48 per minute, her temperature per rectum was 102° F., also both legs were slightly oedematous.

She died August 6, 1910, of exhaustion.

*Gross description of the uterus*—The uterus is much enlarged, about the size of a 4-month pregnancy, and contains a mass the size of a large English walnut (Fig. 1, A) just posterior to the origin of the left broad ligament, the whole measuring over 12 cm. The cavity (Fig. 1, B) is clean smooth and not distended. It contains no polypoid growths. The left wall of the uterus is 3½ cm. thick, but has no changes other than thickening that can be found macroscopically. The tubes and ovaries appear unaffected (Fig. 1, B and C).

The tumor mass in the left broad ligament contains a good deal of hemorrhage (Fig. 1, a) and many translucent vesicles (Fig. 1, b).

<sup>1</sup> Read before the Chicago Gynecological Society, November 1912.

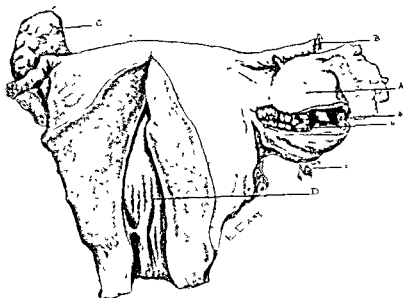


FIG. 1. Uterus and adnexa. (A) Tumor mass in broad ligament to which is adherent a piece of omental fat. The tumor is split open showing (a) hemorrhage in its depths, (b) many dilated translucent vesicles, (c) a few pendulous opaque vesicles. (B) The tube is seen just above the tumor mass, apparently normal except for a slight shortening. (C) Ovary, which is firm and somewhat atrophied. (D) Uterine cavity and cervical canal, which is clean and free from any growth. The specimen measures over 12 cm. in its transverse diameter. The uterine wall is 3½ cm. in thickness.

also a few opaque ones (Fig. 1 c). On the right side of the uterus posteriorly where the wall merges into the broad ligament is another group of these vesicles with however not much if any hemorrhagic reaction around the area. These areas are definitely circumscribed and probably metastatic and they have no connection with the cavity of the uterus.

The left ovarian vein (Fig. 2) is composed of a tumor 5 cm. in length. On cut section the lumen of the vein for the most part is dilated and occluded by either the dilated vesicles (Fig. 2 a) or by a growth that very much resembles a cauliflower (Fig. 2 c). There is some hemorrhage, but this is not marked (Fig. 2 b).

The post mortem examination was held three and one half hours after death.

**Anatomical diagnosis.** Absence of uterus and adnexa, metastatic nodules of secondary chorio-epithelioma in the lungs, spleen, diaphragm, dura mater, spinal cord, pulmonary

arteries, ovarian and iliac vessels, and thoracic duct, anaemia, fatty changes in the liver, passive hyperaemia of the kidneys, bilateral fibrous pleurisy, a staphylococcus and colon bacillus in the body cavities and blood.

**Condensed post mortem report.** The left lung is attached to the pleura by scattered bands of adhesions. The lower lobe is adherent to the diaphragm on its anterior border. The right lung is attached to the posterior chest wall along the vertebral margin by a few bands of fibrous tissue. The lungs crepitate on pressure and contain nodular areas. On cut surface there are many nodules, varying from very small ones to ones 2 cm. in diameter, being especially large at the point of entrance of the pulmonary vessels. Beneath the pleura are many similar areas, wedge-shaped with their bases at the pleura. One of the pulmonary vessels is filled with the tumor mass, and many of the smaller vessels are filled with similar solid white plugs. The spleen shows two infarcted areas on its





Fig. 2 Section through the ovarian vein removed during hysterectomy. The mass is composed of distended ovarian veins containing tumor mass adjacent tissue into which some hemorrhage has occurred, and the surrounding fatty tissue. The drawing represents this tissue split open. (a) Dilated vessel in the lumen of the vein (b) An irregular solid white mottled tumor mass in a vein (c) Hemorrhage into the surrounding tissues (d) Adipose tissue

surface. The right ovarian vein is greatly enlarged, with irregular sacculated dilatations and is partly filled with a solid appearing white mass. The left external iliac vein has attached to its inner surface a similar white mass about the size of a pea. The left external iliac artery is filled with a similar mass. There is a tumor mass just above the pillars of the left leaf of the diaphragm as large as an English walnut. It is opposite the body of the twelfth thoracic vertebra. Another slightly larger tumor mass is present just under the pillar of the diaphragm on the right side. There are no gross changes in the vertebrae. In the lower thoracic part of the thoracic duct there is a mass 5 cm long occluding the lumen. This mass is irregular in shape and white in color containing some blood-stained areas. On the vertebral side of the cord there is a cavity about 1 cm in diameter (Fig. 3, a), and this lies in the region of the cauda equina.

Its walls are lined with necrotic tissue, which is granular and hangs in shreds.

*Microscopical* The tumor tissue is nearly all limited to the blood sinuses in the region of the tumor of the broad ligaments. These spaces contain villi which are large and somewhat distended, no blood-vessels, of course, are found in them. These villi all contain on their margin a distinct layer of Langhans' cells outside of which is a border of syncytium. In some areas there is an active proliferation of both cell types but the increase is mostly in the Langhans' cells. Whole islands of Langhans' cells are found at the margins of the elongated villi, in which are evidences of rapid cell division and a few mitotic figures. In a few areas syncytial or wandering cells infiltrate the uterine wall chiefly between the muscle fibres. In this region is also some round-cell infiltration and an invasion of leucocytes. Very little necrosis and hemorrhage have occurred. There is little vacuolization of the syncytium and the cells are apparently strong and healthy.

The tumor in the ovarian vein removed at the time of the hysterectomy also contains

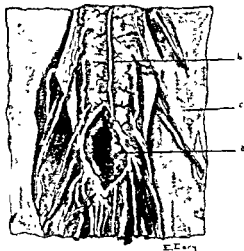


Fig. 3 Cavity in the vertebral side of the spinal cord. This cavity is in the cauda equina. Its walls consist of necrotic tissue which is very friable. The lumen is about 1 cm in diameter. (a) cavity, (b) artery (c) meninges of the cord opened out

villous growths, but the arrangement between the syncytium and Langhans' cells is not so regular or typical. In some extensive areas the epithelial covering of the villus is entirely absent. The relation of the two cell layers, however, is still maintained. In this region hæmorrhage is a prominent feature and the corrosive action of the tumor is manifest, for in these blood spaces, which are filled with fresh blood, fibrin and cell detritus line the villi. Polyhedral cells are also present with some proliferating syncytium.

The metastatic tumors in other parts of the body contain, for the most part, a central mass of disintegrated blood and débris, surrounded by a row of cells that are for the most part of Langhans. Hæmorrhage is prominent about this central area, and the cells invading the surrounding tissue seem to work in between the normal tissue cells where pressure atrophy occurs. In free blood-channels, in a few instances, the masses attached to the adjacent tissues, consisting of Langhans' cells surrounded by a thin layer of syncytium. In one blood-vessel in the tissue removed from the prevertebral region is a villus whose central part is necrotic but which is still surrounded by epithelium composed of an incomplete row of Langhans' cells outside of which lies syncytium. At one end of the villus are two or three syncytial giant cells and an area of actively proliferating Langhans' cells with one or more mitotic figures present.

As Schmauch states in his paper, it is difficult to ascertain the true character of the growth from some of the descriptions, because cells defined as syncytial cells by one author are defined by another as Langhans' cells. This latter name should in all cases be restricted to the sharply defined cells with lightly staining protoplasm, distinct nucleoli, and a chromatin network, and surrounded by syncytium. "The true chorio-epithelioma is a well-defined structure resembling the epithelial covering of a villus in the early stages of gestation and placentation, namely Langhans' cells permeated and surrounded with syncytium, and plasmodial masses resembling the syncytial ends of villi." Through the works of Fleischmann we have come to

know of a chorioma that is made up of cells wholly syncytial, which are for the most part mononuclear or may contain two or even three nuclei; the protoplasm is typical. This type of chorio-epithelioma Schmauch believes should be designated as "atypical." This one-celled type, a syncytial cell, which looks somewhat like a decidual cell, represents one of the three types of trophoblastic cell, and this type is not able to assume the other two forms. "It is probable that the atypical chorio epithelioma is only a later stage of the other forms, in a similar way as the syncytial cell is a later stage of the trophoblast and its derivatives, the Langhans' cell and syncytium (Schmauch).

A brief consideration of the classification of these tumors, as represented by the works of Marchand, Ewing, and others will perhaps make the subject more clear. The "typical" chorio-epithelioma, according to Marchand's classification, is composed of multinuclear, eosinophile, syncytial masses and a smaller number of mononuclear, polyhedral, lightly staining Langhans' cells, which may or may not be in villus arrangement. It is the mildest type of tumor originating from the foetal ectoderm and possesses fairly constant characteristics. Ewing has termed this "chorio-adenoma destruens" or "malignant placental polyp." When villus formation prevails they invade a large area, cause the uterus to become enlarged uniformly, and may project into the cavity as a polypoid mass. The growth extends to the broad ligaments, but tends to remain confined to the uterus. The cells have only a limited ability for growth outside of the structures of the villus. It is the exception to find villi in the metastatic tumors. Only branching ends of the vacuolated syncytium and sharply defined Langhans' cells without much morphological deviation from the normal are most characteristic.

As early as 1886, H. Klatz noted this condition in three cases of destructive placental polyp and termed it "adenoma of the placenta."

The "choriocarcinoma" of Ewing corresponds to the malignant chorio-epithelioma of Marchand. This growth is recognized by the absence of villi and the extensive prolifera-

tion and metaplasia of the Langhans' cells and of syncytium. The tumor cell possesses remarkable capacity for independent growth away from the villi and a loss of cell differentiation in the secondary growths. The primary tumors in the uterus are comparatively small—in some instances reported as absent, or so small as not to be found, and the organ but slightly enlarged, while numerous metastases are found in the other organs of the body. In the "atypical" chorio-epithelioma, actively proliferating Langhans' cells and syncytium are missing. The uterine musculature is infiltrated with large acidophile, mononuclear cells which, it is asserted, arise from the ectodermal cells of the fetus. These are sometimes called syncytial wandering cells, on account of their resemblance to and association with masses of syncytium. There are large variations in this form, and Marchand emphasizes the infiltration of the musculature of the uterus. Lwing has termed this process "syncytial endometritis."

Meyers states, and I think that we all know that an invasion of the uterine musculature with these cells is found in the early months of pregnancy and continues to the sixth month, but may and should be entirely missing at full term. These syncytial wandering cells resemble decidual cells very much, but they can be differentiated by the fact that the cytoplasm of the former is more opaque and acidophile, and the nucleus larger and richer in chromatin. These cells form considerable masses, are usually largely necrotic, and mixed with blood clots and fibrin. Large, circumscribed well nourished tumors made up of such wandering syncytial cells with metastases of similar structure have been observed (Lwing).

In certain growths there is more or less absence of Langhans' cells and increase of the syncytium or wandering cells or both, called by Lwing "transitional syncytial chorioma or syncytionia." He considers these retrograde forms of the more malignant types in which the cell vitality has become depleted. In short, these tumors stand between the choriocarcinoma and the chorio-adenoma on the one hand and the syncytial endometritis or atypical chorio epithelioma on the other.

As regards malignancy and non-malignancy of chorio-epithelioma, Schmauch has made some very interesting deductions in conjunction with the work of several others. He says, "The presence of plasmodium when not connected with a villus must always be regarded as a sign of malignancy." Also "The assemblage of well defined cells of the character of those forming the Langhans' layer, no matter what size or form, amongst healthy tissue or true plasmodium is, when found several months after expulsion of the ovum, an unmistakable sign of boundless growth."

The atypical chorio-epithelioma or transitional type is, I believe, conceded by most authors to be less likely to terminate fatally, and spontaneous recovery to occur in a great many cases, also the metastases are more infrequent and may retrogress. Why is this true, or is it true?

It is shown that the Langhans' cell is the most vitalized cell of ectodermal origin and is always the chief proliferating part of a malignant chorio epithelioma. Its action is most corrosive upon maternal tissues, therefore it is only reasonable to assume that with the predominance of these cells the invasion of the maternal host would be most rapid. According to Schmauch and Velitz, spontaneous recovery is brought about by necrobiosis, which is manifested by the diminished vitality of the Langhans' cells, absence or scarcity of mitosis, and the appearance of numerous wandering cells. The true arrangement of syncytium and Langhans' cells is lost, and atypical Langhans' cells, syncytium and wandering cells make their appearance, which latter are believed to be degenerative and necrobiotic forms of the original chorio-ectodermal structures.

Briefly, it is believed that the transitional and atypical forms of chorio epithelioma are tumors that have undergone retrograde changes. The vitality and virulence of the cells is diminished, and the growths present only degenerative forms, which, as in the history of all such conditions, are spasmodic attempts on the part of the cells to reproduce their kind, and on account of their lessened vitality are merely abortive forms of the original condition. For these reasons and

the reported recoveries after operation following this type of tumor, the latter forms of chorio-epithelioma are considered less malignant than the typical forms. Still, from the viewpoint our case gives us it would tend to show that, although a chorioepithelioma may be malignant and a chorio-adenoma usually benign or much less malignant, the picture may change and a tumor which at first appears benign may later become malignant. Therefore, if an apparently benign case may later become malignant why is it not reasonable to assume that an apparently malignant case may retrogress and become benign, especially inasmuch as the more benign cases are conceded to be retrogressive forms of the once typical chorio-epithelioma? In short, while the different histological pictures may be some guide as to the prognosis, they cannot by any means be regarded as conclusive.

Some difficulty is encountered in attempting to place this tumor in the proposed classification, because, while the examination of the uterus alone would beyond all doubt place it as a chorio adenoma, the further course of the conditions would tend rather to disqualify this statement. Without doubt it was primarily a chorio-adenoma, both from the microscopical picture and from the clinical history. The exceptional features were that the uterine cavity remained apparently clean after curettage and that the extension was considerably more than is usually found in this condition.

Solowij and Kryzskowski reported a case in 1900 in which a whole villus was found in the lung. In our case several villi were found outside of the uterus — a rare condition. These were seen in the broad ligament, the ovarian veins, and three years after the hysterectomy in a vessel in the prevertebral region, and one or two attempts at villus formation in the pillars of the diaphragm. The presence of these villi would lead one to believe it to be more or less benign; but the fact that an overwhelming secondary growth recurred practically all over the body, in conjunction with an active proliferation and metaplasia of the Langhans' cells and the presence of mitosis, would speak for an active malignant tendency.

Teacher, in 1903, collected a series of 188

cases, in which radical operation was performed 99 times, with 63.3 per cent of recoveries. In all of these cases recurrence was noted within six months or not at all, with the exception of five cases, the latest of which recurred at the end of one year.

In this connection it is interesting to note that the choriomata following full-term deliveries show after operation a higher percentage of mortality from recurrence than those occurring after either abortion or hydatid mole. He states the percentage of recoveries to be 20.4 after labor at term; 46.6 per cent after hydatid mole and 33 per cent after abortion.

Other observers have reported cases in which the secondary manifestations were delayed over varying lapses of time, but very few have reported cases where hysterectomy had been done previous to these manifestations and following the condition that was the causal factor. For this reason our case would stand as exceptional, because the secondary manifestations occurred late after hysterectomy, when if they were to occur at all, it would seem reasonable from past experience that they occur early. Loehlein reported a case in which recurrence was delayed for a year. Dukeman last year reported a case in which the main symptoms were bleeding at irregular intervals and passage from time to time of masses of tissue, with gradual loss of weight and strength. This was preceded by an abortion, and three years later hysterectomy revealed the presence of chorio-epithelioma, in all probability a malignant placental polyp, as villi were found in the uterus. M. Caturani also reported a case last year in which a tumor developed in a woman 51 years of age, five years after the passage of a hydatid mole; but hysterectomy had not been previously performed. Bland in 1902 speaks of a case developing a chorioma six years after a full-term delivery, and in 1900 Kaufman reported a similar case showing symptoms two years later.

In reviewing these cases with long intervals between the labor or abortion and the manifestations of the tumor, one will immediately be struck with the idea of whether or not the

woman had not become pregnant again. In fact some of the authors place a question mark after the statement that no pregnancy has occurred during the intervening period. This is perhaps more forcibly borne out by the table Ladinsky published in 1902, in which he states that the average time when the primary manifestations occur following the different conditions was, for labor at term, five weeks, for abortion, seven weeks, after expulsion of hydatid mole, eight weeks.

It was noted that in our case the clinical symptoms appeared relatively early, and at first they followed out the general behavior of the average case of chorioma. It was interesting, too, to note that after hysterectomy the case made an uneventful recovery, for if metastases are going to occur, operation only hastens the fatal termination. It is difficult to decide why the growth should remain dormant and then flare up with such rapidity. At best only conjectures can be made on this point. Was the resistance of the maternal tissues enough to inhibit the corrosive action of the chorionic cells until the attack of pneumonia lowered the bodily resistance and allowed of an invasion and unrestricted growth of the foreign cells, or was the pneumonia a premonitory manifestation of the growth of the cells in the lungs? This cannot be answered, as we do not understand well enough why a cell at one time can easily destroy tissue and at another exert very little if any destructive action toward these same tissues. It is enough to call attention to the fact that there was a complete subsidence of the growth for nearly three years after radical removal of the uterus and adnexa. From this slightly different viewpoint, it may bring to light cases that were reported as having completely recovered dying years later from general metastases, when death was attributed to some natural cause.

Brain metastases are not uncommon and may be found mentioned in a number of cases. Inglis and Bruce, in 1909, reported a case that died of brain hemorrhage six months after expulsion of a hydatid mole with brain metastases. Dunger also reported a similar condition, in which the patient died three years after a molar pregnancy. In our case

paraplegia developed, and although the lesion showed no definite living tumor cells the condition was undoubtedly due directly or indirectly to a metastatic focus, and is the only lesion of the cord that has been reported, as far as I have been able to find in a review of the literature.

In conclusion, one would be justified in calling this case a chorio-adenoma with malignant tendencies. It represents what Ewing terms "potential malignancy," for both the clinical and histological picture is that of a rather benign chorioma. This benignity lasted for nearly three years, when the malignancy of the condition appeared, as shown by the fatal termination from general metastases; which metastases, in contrast to the earlier tumor growths, gave a sinister picture, containing many Langhans' cells with mitotic figures, necrosis, thrombosis, and a leucocytic reaction. These latter Meyers considers the essentials of malignancy.

The three most exceptional features in the case are, first, the presence of villi in the secondary tumor growths, secondly the long lapse of time after operation before fatal termination of the condition from metastatic growths, and lastly, the peculiar lesion in the cord that gave such interesting clinical manifestations of paraplegia. The first two conditions have been noted in the literature, but as far as I have been able to ascertain the lesion in the cord is unique.

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INDICATIONS FOR AND RESULTS OF OPERATIVE TREATMENT OF OTITIC MENINGITIS<sup>1</sup>

By EWING W. DAY, M. D., PITTSBURGH

UNTIL 1893, when Macewen published a report of six recoveries out of twelve operative cases, no serious attempt had been made to treat suppurative otitic meningitis surgically. The prognosis had been so uniformly unfavorable when either medical or surgical methods were used that the outlook then for obtaining a curative procedure for this most dreaded of aural complications was most discouraging. Since Macewen's report, however, interest in both the medical and surgical treatment of meningitis has been renewed. Improved laboratory methods and the introduction of lumbar puncture have made more accurate diagnoses possible. Old methods of treatment have been revised under more favorable conditions, new ones have been enthusiastically advocated. Results, while indicating that modern therapy has entered only the border line of the disease, have been sufficiently encouraging to justify at this time more persistent and painstaking research than ever before.

It is true, however, that unfavorable results, of which there must be a vast number, do not appear in the literature, so that while we should not underestimate the progress that has been made toward successful therapy we should not minimize the fact that at the present time suppurative meningitis has the highest mortality of all aural complications. In view of this it does seem that, with everything to gain and nothing to lose, we are justified in trying any treatment, medical or surgical, which suggests the slightest hope of relief.

It is our purpose in this paper to carry out the suggestion of your programme committee and give you our results as they have occurred—our mistakes, failures, and apparent successes, in a plain, unvarnished summary.

The writer has treated 57 cases of meningitis since 1897, 53 were of otitic origin,

2 of nasal, and 2 secondary to pneumonia. These were all diagnosed as diffuse suppurative meningitis, and the diagnosis was confirmed in 38 cases by autopsy. Four cases recovered—3 through operative means and one with the aid of vaccine therapy. One of the 3 cases, however, died three months later from a reinfecting meningitis. These cases will be referred to later.

Meningitis followed chronic purulent otitis and its acute exacerbation twice as frequently as the acute purulent otitis. That complicating acute otitis was more often of an explosive type, running a rapidly fatal course. That following chronic purulent otitis was less liable to be explosive in type, having a more protracted course. In addition, with chronic otitis an apparent prodromal stage could often be discovered, extending from a few days to as long as 115 days, in one case before the meningitis was clearly defined. The symptoms were generally slight recurring headaches and malaise, usually assigned by the patient to a disordered stomach or "biliousness." This history, elicited too often to be merely accidental, indicates without doubt in some cases a latent or slowly progressive stage of the meningeal infection. If such a stage exists following acute otitis, it is so masked by the acute condition of the ear that at present we are utterly unable to define it. The work undertaken by Kopetsky, when put on a practical working basis, will be especially valuable in detecting these latent invasions.

Seven of our cases were complicated by sinus thrombosis; 8 by brain abscess, and 10 by purulent labyrinthitis. In only 3, however, was a diagnosis of labyrinthitis made before autopsy. Many more probably would have been found if proper means of diagnosis had been employed, but the writer's knowledge of labyrinthine involvement and

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America, New York, November 24, 1912.

its significance prior to the published works of Barany and Neumann was too hazy to be of value.

The treatment of our cases varied. The mastoid operation, either simple or radical, was performed in 48 cases. In 15 no other surgical means were employed, in 33 cases the mastoid operation was supplemented by other procedure directed to the infected meninges—in 10 cases by dural drains; in 8 by simple incision of the dura for drainage, in 4 by autogenous vaccines, in 3 by drainage of the *cisterna magna*, in one by drainage of the lateral ventricle, in one by lavage of the ventricle, in 4 by intraspinal injection of urotropin solution, in 2 by intraspinal injection of oxycyanide of mercury.

It is impossible to establish definitely the indications for operation. All, however, agree that it must be done early, practically before the meningitis has developed. This means that the operation, to accomplish its purpose is not one for the cure of a diffuse meningitis, but one to prevent suspected localized meningitis from becoming diffuse. What then, are the indications of a beginning or threatened invasion of the meninges? Have we any diagnostic means at our command that will aid us at this early stage? If there are any of precision they are unknown to the writer for the indefinite history of malaise already referred to is too vague to be of great value. However of the early symptoms of meningitis, the two mentioned by Haynes, steady increase in blood pressure and *oedema of the papilla*, are a distinct help. Unfortunately they were not accurately noted in our histories. In two cases a slight *oedema of the disc* was recorded. More often the eye grounds were reported as normal. It is upon early diagnosis that successful therapy in the future will greatly depend.

Of diagnostic methods, lumbar puncture at the present time gives us the most reliable information as to the condition of the meninges. The presence of pus cells or pyogenic organisms in the fluid is usually considered diagnostic of suppurative meningitis. Slight turbidity cannot be accepted as a positive sign of a diffuse process, for it may result from a very limited area of infection. In

serous meningitis, a slight turbidity may be present with no pathogenic organism. Decided turbidity, on the other hand, with a markedly increased number of polynuclear leucocytes in the presence of pyogenic organisms, indicates an extensive involvement and a correspondingly hopeless condition.

Some otologists attach much less value to lumbar puncture than we do. Thus Alexander states that "the result of lumbar puncture gives a clear idea of the meninges, the result cannot, however, be said to have any bearing upon or be a contraindication to operation. The absolutely hopeless prognosis of an operation can only be furnished by the clinical picture or symptoms, never by the result of lumbar puncture."

Keever, referring to the diagnostic value of lumbar puncture, says that "from an extra or intradural abscess, a brain abscess, a sinus thrombosis, or a labyrinthine suppuration, cerebro-spinal fluid may be flooded with leucocytes, bacteria, and toxins, and thus cause or lead to a fully developed meningitis symptom complex, without the presence of any cloudiness or suppuration in the soft brain coverings." This condition he designates as the "Vorstufe" or premonitory stage of a purulent meningitis. In other words the findings from examination of the spinal fluid might under certain conditions lead to a diagnosis of a more serious condition than really existed. In none of our fatal cases in which the spinal fluid was examined did we find that this occurred. In three instances the examination of the spinal fluid led to underestimation of the gravity of the brain condition. In these, repeated punctures showed a slightly clouded fluid, non-pathogenic bacteria, and leucocytes but no infective organisms. On post-mortem examination, however, streptococci were obtained in abundance, both by smears and culture from the dural spaces.

Holger, in discussing the operative treatment of suppurative meningitis, states that in cases of localized inflammation of the meninges he never found any alteration in the spinal fluid.

Despite the findings of these men, in our opinion examination of the spinal fluid is the

most important means of diagnosis. Unfortunately, as now employed by the most of us it seldom gives warning of a threatened invasion, but of one under way.

The bacteriology of the primary aural infection offers no indication for or against operative interference. For it does not always follow that the organism found in the ear at time of examination will be identical with that in the dura. This is especially true in chronic purulent otitis media. In one case, staphylococci and non-pathogenic bacteria were obtained from the ear, but the streptococcus capsulatus mucosus was the meningeal organism. In several others, staphylococci were present in the ear and streptococci pyogenes in the dura. In another, no pathogenic micro-organism could be found to account for a streptococcic meningitis.

Nor does the nature of the dural infection offer any indication for or against operative measures. The individuality of the organism seems to make but little difference in the course of the disease, either before or after the operation. In our cases, the average duration before death of pneumococcic meningitis was nine days, streptococcic eleven, and in the two cases of staphylococcic ten and eleven days respectively. Those cases with mixed infection were much slower in their termination.

Of more importance in influencing the course of the disease is rather the virulence of the infecting organism. Our experience coincides with that of MacCuen Smith, in that the pneumococci give rise to a meningitis which in severity is equal to if not greater than that streptococci causes. His statement that cases of staphylococci meningitis will most likely recover, however, is contrary to the result in two of our cases, which were of more than average virulence. The virulence of the infecting organism is apt to be of a mild grade in those cases where the spinal fluid is either free from bacteria or contains only attenuated forms.

Lastly, the clinical condition of the patient, even if grave, offers no contraindication to operative procedure. In cases of moderate severity the brain symptoms showed improvement, sometimes extending over several

days. In the worst type the condition remained unchanged, and death was in no ways hastened by the operation. On the contrary, we are of the opinion that by drainage and the relief of pressure the average duration of the disease has been perceptibly raised. The average length of suppurative meningitis is given as seven days. The average duration of our cases operated upon was thirteen days. The number, however, is far too small to justify conclusions.

Before proceeding to a consideration of the treatment of otitic meningitis, we should like to emphasize the importance of post-mortem examination in the solution of this problem. If autopsies accomplish no other purpose, they show us what effect our operative treatment has had on the progress of the disease. With this in view, the board of managers of the Eye and Ear Hospital in 1908 passed a rule requiring that all patients admitted to the ear wards, or their legal guardians, give permission for autopsy in the event of death. Since the enactment of this regulation, all of our fatal ward cases, without exception, have had post-mortem examination.

The treatment of suppurative meningitis by the administration of drugs per oram has been proven so absolutely valueless, except possibly in the use of urotropin as a prophylactic, that no comment is necessary.

There then remain only local antisepsis, vaccine therapy, and surgical procedure, until the laboratory and research workers come to our aid with something of greater value. Theoretically, surgery should give relief. Practically, the mortality has not been changed by it. Theoretically, an operation should be done early, while still localized. Practically, we have to take the patients as they come to us, many of them with a diffuse involvement of the meninges, and do the best we can.

#### METHODS OF TREATMENT

The various methods of treatment employed in our cases, either singly or in combination, were:

- (a) Injection of drugs into the spinal canal.
- (b) Vaccines and sera
- (c) Operation.



The operative procedures were:

1. Eradication of the primary focus of infection in the ear and adnexa.
2. Exposure of the dura around the ear and drainage from the site of primary invasion.
3. Drainage of lateral ventricle for relief of pressure.
4. Attempted irrigation through the lateral ventricle to a needle in the lumbar spinal canal.
5. Drainage of the cisterna magna.

The favorable reports given the writer by Dr. McKernon led us to use urotropin intraspinally in 4 cases. Of these, 1 had streptococci in the spinal fluid, and one pneumococci. In only one case, a streptococcus, was even temporary improvement noted. Our technique consisted in injecting gradually a sterile solution of 100 gr. of urotropin in such concentration as not to exceed in bulk one half the amount of spinal fluid removed. Three hours after the injection the patient's temperature fell from  $103.5^{\circ}$  to  $102^{\circ}$ . The next day it returned to  $103.5^{\circ}$ . A second injection of urotropin was followed by a drop of only one half a degree. Two subsequent injections of the same amount, at intervals of 12 to 24 hours, produced no perceptible change. No ill effects of these large doses of the drug on the kidneys or other organs was noted.

Of the other 3 patients, 2 had three injections and one two injections without change in their condition or alteration in the course of the disease. However, the possible benefit from urotropin should not be underestimated because of our non-success, for in Dr. McKernon's hands there have been a number of recoveries.

We tried the intraspinal injection of the oxyanide of mercury in two cases who were in desperate condition, within half an hour of each other, largely because their relatives were insistent that this drug should be used. In the first case, a girl of seven with only a few hours to live, one tenth of a grain of the oxyanide of mercury in one ounce of sterile water was injected. This was quickly followed by intense restlessness and bladder and rectal irritation. Later cardiac failure super-

vened, with pulmonary edema, and death six hours from the time of injection. Autopsy revealed in the posterior part of the temporal lobe a large abscess which had ruptured into the lateral ventricle, and acute congestion of the kidneys.

In the second case, where the meningitis developed one week after an operation for thrombosis of the right lateral sinus and internal jugular vein, one fifteenth of a grain of oxyanide was used. Here similar irritation symptoms followed, and later cardiac weakness, vesical and rectal paralysis, and acute nephritis. Death ensued nine days after the injection, from a thrombosis of the lateral left sinus. The spinal fluid, which had contained pus and streptococci before the injection, on the day following and subsequently was free from bacteria. Autopsy showed that the meningitis, which had extended over a great part of the right hemisphere, had subsided. Cultures taken were negative. However, any benefit from the drug that may have resulted in the meninges was offset by the inflammation in bladder and kidneys, acute enough to have caused early death.

Vaccine and serum therapy in suppurative meningitis seemed to us to offer great possibilities, and after our first trial, which, as so often happens, was our most successful one, was enthusiastically advocated. The patient, a girl of 10, was operated on December 6, 1908, for simple mastoiditis. Fifteen days later there was evidence of diffuse suppurative meningitis, with streptococci and pus in the spinal fluid. At the end of 48 hours 10 cc. of antistreptococcal serum was injected intraspinally, and 12 hours later, one hundred million dead streptococci in autogenous vaccine subcutaneously. These injections were repeated in the next 48 hours. On the fifth day after onset the maximal daily temperature had dropped a degree, from  $103^{\circ}$  to  $102^{\circ}$ , and the spinal fluid was clearer. From this time on there was steady improvement in the patient's condition, the temperature reaching normal on the eighth day. Several more subcutaneous vaccine injections were given during convalescence. The patient has been seen at intervals since leaving the

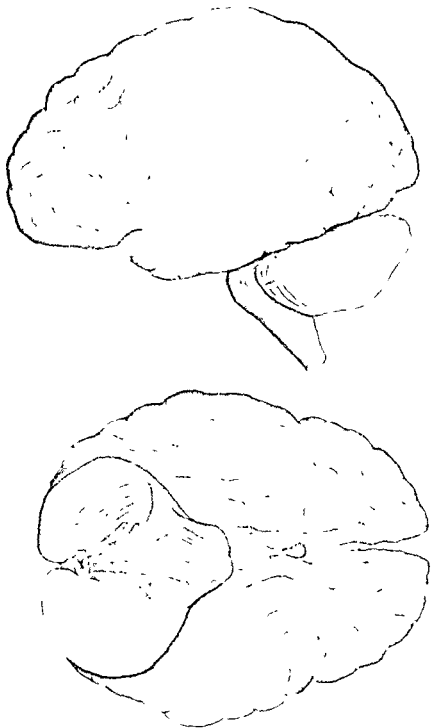


Plate I Extent of effective subdural drainage in temporal and cerebellar regions  
Death and autopsy two years after drainage for influenza meningitis (Illustrating  
article on "Indications for and Results of Operative Treatment of Otitic Meningitis,"  
by Fwing W. Day )



hospital, and to-day is in normal health. The second case in which vaccines were used improved markedly for three days, and was expected to recover, but then became gradually worse, and died on the fourteenth day. The two remaining cases showed no reaction to vaccines. In a number of others they were tried in conjunction with dural drainage, but without noticeable benefit. We have, therefore, come to doubt the utility of vaccine therapy in suppurative meningitis, and have discontinued its use, though with great reluctance.

The aim of operative procedure in otitic meningitis is twofold. first, prophylaxis, and second, radical cure. A prophylactic operation eradicates the primary focus in the ear and adjacent bony cavities. As a measure to prevent the spread of infection to the meninges this is of utmost importance; as a curative one, when meningitis has actually developed, it is of little value, for it will not arrest the advance of the inflammation, and should be considered, therefore, only as a minor part of operative procedure. Removal of the primary focus was a preliminary step, as already stated, in 48 of our cases, regardless of after procedure. In no case could we see that this alone had any influence on the course of the meningitis. In one case, we feel positive that by a radical mastoid operation a latent or circumscribed meningitis was converted into a rapidly fatal one. Whether the dura should be exposed at the primary mastoid operation must be decided by the operator from the clinical data. With no signs of infection beyond the temporal bone, no useless exposure of the dura to possible infection should be considered.

In 18 of our cases, the surgical procedure directed against the complicating suppurative meningitis attempted first to drain the original area of meningeal infection; secondly, to relieve pressure. Haynes, Cushing, and other writers now place greater importance on the relief of pressure than we did when treating these cases. To render the middle and posterior fossæ freely accessible, and to insure adequate drainage, the mastoid opening is extended into a craniotomy, up-

ward, forward and backward until the following sections of the dura are exposed:

1. That portion above the tympanic cavity and roof of the mastoid antrum.
2. That portion over the sigmoid sinus and the cerebellum posterior to it.
3. That covering the anterior surface of the cerebellum and the posterior part of the petrosal pyramid. If necessary, the Neumann operation on the labyrinth is done. The error is more often made of having the cranial opening too small than too large; it must be ample enough to allow all further procedure with a minimum of manipulation.

In our technique, as a rule three incisions, about 1 cm in length, are made through the dura above the tentorium and middle ear, and two along the anterior surface of the cerebellum. Incision of the dura posterior to the sinus is no longer employed, as those on the anterior surface seem to drain that lobe of the cerebellum as thoroughly as when incisions posterior to the sinus were used. An olive tipped probe is then inserted between the dura and brain tissue and gently swept in segments of a circle for a variable distance, breaking up the arachnoid meshes, and drains are introduced. These drains are made of two strands of fine catgut, twisted and doubled back, so that there are four strands with loops at the end to be inserted under the dura. Wrapping them in rubber tissues or Cargile membrane facilitates their entrance. On account of the distention of the spaces from the cerebral fluid, this is not usually difficult. When, however, the brain tissue is under great tension, insertion may be impossible, and the use of drains should not be attempted. The drainage of cerebral fluid from this procedure is generally copious enough to moisten the dressing and require its changing two or three times in 24 hours. The drains are of maximal efficiency early, and usually cease to be of use after 36 hours, nor will the insertion of new drains restore the flow.

Up to the present time we have apparently had greater improvement in our cases as a result of this method of treatment than of any other. The benefit was decided, even to the point that recovery was pre-

dicted in those cases where the dura showed distinct inflammatory changes in the exposed area. The improvement varied in duration, from two to three days to as long as three months in one case.

The three cases of dural drainage which recovered were all complicated by brain abscess secondary to chronic purulent otitis media in one, cerebellar; in the other two, temporo-sphenoidal, the meningitis beginning shortly after the operation for the abscess in each case. In the cerebellar case an abscess occupying almost the entire left lobe, leaving only an outer shell, was evacuated. Pus from the abscess showed a mixed infection of streptococci and non-pyogenic bacteria. Seven days later there were symptoms of meningitis. The second operation revealed a large distended lateral ventricle, which was drained, and dural infection in the vicinity of the pyramid. This bone was partially removed, the labyrinth opened, and the dural drains inserted. Convalescence progressed slowly to apparent recovery though the cerebellar abscess cavity never completely healed. One hundred and fifteen days after the operation for dural drainage, meningitis recurred and death came in four days. Unfortunately no post-mortem examination was held.

In the other two cases, those with temporo-sphenoidal abscess in three and four days respectively after evacuation of the abscess symptoms of meningitis developed with turbid spinal fluid containing, in one the influenza bacillus, in the other streptococcus. Dural drains were used as described, but their introduction was difficult because of pressure from the protruding brain. Both patients had an uneventful convalescence and were discharged after several weeks. The case which had the influenzal infection was seen at intervals for a year and remained well. The streptococcic case was readmitted to the hospital two years later with a recurrence of abscess in the old cavity, and died from a rupture of an undrained pocket into the lateral ventricle.

One half hour after death the practicability of washing out the arachnoid spaces through a cannula introduced into the

posterior horn of the lateral ventricle, with an exit given by a second needle in the lumbar region, was put to test. A solution of methylene blue was used, at an elevation of one foot. In five minutes the blue solution appeared in fast drops from the lumbar cannula, and was allowed to flow for several minutes; then an autopsy was done. The blue was found to penetrate the subdural arachnoid spaces over the temporo-sphenoidal region partially those in the parietal region near the longitudinal sinus and less markedly, but noticeably those over the frontal lobes. The sheaths of the optic nerves were deeply stained. Over the cerebellum, the medulla and cord, the stain was a deep blue. Standing out clearly in this blue field was an elliptical area approximately four inches in its long diameter by two inches in the short, situated on the outer and under surface of the temporal lobe and cerebellar lobe of the left side into which no staining fluid had penetrated. Here the membranes were cemented together and the arachnoid spaces destroyed. The clear space corresponded to the center of the area in which dural drains had been used two years previously. In seven other autopsies of cases in which dural drains had been used this clear area was noted, while beyond this region thick purulent exudate was abundant.

We have come to believe that this elliptical clear area represents the limit of usefulness of dural drains in the region of the petrous bone. That they do not drain satisfactorily the central lobe of the cerebellum or lessen the inflammatory action over the base of the brain or spinal cord seems certain. We have also concluded that the drainage of cerebral fluid which occurs at first, and generally ceases in from 24 to 36 hours, does not stop from plugging around the bony opening, but because the brain pressure destroys the spaces no longer distended by the fluid and permanently seals them off from the remaining arachnoid.

It is claimed by some writers that several incisions alone in the dura give results equal to those where dural drains are used. Our post-mortems have shown that the elliptical area, if present, is not nearly so clear and

extensive when incisions only are used, so that now we never stop there if it is possible to insert the catgut drains.

In the light of our findings, then, the three cases of recovery which have just been referred to, which presented all the clinical and laboratory evidence of diffuse meningitis, and which we have congratulated ourselves on curing, may after all have been simply cases of localized meningitis, limited to this elliptical area.

It was realization of the limitations of dural drainage therapy that led us to other methods. The suggestion of Barr of Edinburgh to irrigate through the lateral ventricle and out through a lumbar cannula was tried in one case, a moribund patient, but our efforts to establish a flow of the methylene blue solution in a period of fifteen minutes were unsuccessful. Post-mortem examination on the following day showed small ventricles with openings blocked off, nearly free of fluid, and no evidence of the irrigating fluid in the spinal canal or arachnoid. The attempt proved nothing except that the procedure did not seem to be harmful to the patient. It would undoubtedly have been given further trial but that the treatment of meningitis by draining the cisterna magna, as suggested by Dr Haynes in a paper read in June, 1912, before the American Laryngological, Rhinological and Otological Society, appealed more strongly to the writer.

Since then three cases have been treated in this way

**CASE 1** A Slav, admitted to St Francis Hospital in a delirious state. No history was obtainable. An examination showed every evidence of meningitis, also pneumonia of considerable extent. On lumbar puncture a turbid fluid was obtained containing abundant pneumococci. Regardless of the pneumonia, ether was administered and the cisterna magna opened. The cerebral fluid was under great pressure. A catgut drain was used through the dural opening. The following day there was an improvement, delirium was less marked, temperature and blood pressure were lower; there was less restlessness. No change for the worse in the pulmonary condition could be noted from the administration of ether. But in the next twelve hours the patient grew rapidly worse, delirium passing into coma and death. No autopsy was permitted.

**CASE 2** A baby eighteen months old. On the day previous to entering the hospital the child had been fretful. That night it had repeated convulsions. On the next day one ear showed acute otitis media with serum. Lumbar puncture gave a clear fluid, under pressure, loaded with pneumococci. Twenty-one hours from the time of the first convulsion, and 36 from the first symptoms of fretfulness, the cisterna magna was drained. For two days following the operation there was such decided improvement that strong hopes of recovery were entertained, in view of the fact that the operation was performed so soon after the onset. On the third day, however, a change for the worse took place, and death followed in a few hours. This patient was a private case, and no post-mortem was granted.

**CASE 3** A child of eight years with a double purulent otitis media, a result of measles a month before. Convalescence from the measles had not been satisfactory, and she was sent to the Eye and Ear Hospital for a supposed mastoiditis. Her condition on admission was grave. Lumbar puncture showed a turbid fluid, containing streptococci. The cisterna magna was opened and gave free continuous drainage to the end. For three days after the operation there was a marked improvement, though the child still was very sick. Then followed a slow progressive turn for the worse, with death in seven days. At autopsy little exudate was found over the temporal and occipital lobes of the brain and upper surface of the cerebellum. There was considerable thick exudate over the frontal and parietal lobes. A gelatinous exudate covered the base. The lateral ventricles contained a moderate amount of turbid fluid, while the spinal canal was filled with thick purulent fluid. Sinuses were all patent. Cultures made from the exudate on the brain surface gave a pure growth of streptococcus pyogenes. Apparently operative drainage had prevented accumulation of inflammatory exudate in the subdural spaces posteriorly, but appeared to have no effect upon the extensive accumulation of pus in the pia-arachnoid. Thus it would appear from this autopsy that opening of the cisterna magna drains a wider area and one higher up than dural drainage in the temporal region.

As we review, in this way, our work of the last fifteen years and see the results attained, we must come to the conclusion that the successful treatment of otitic meningitis is still to be discovered. Serum and vaccine therapy have been a disappointment. The one recovery mentioned here can be considered only as an exceptional case. Drugs introduced into the spinal canal which are powerful enough to overcome the infection of the meninges are harmful to other organs,

substituting new pathological conditions for the meningitis. Dural drainage is effective but to a limited extent. When used in the circumscribed form of the disease it does and should give good results. The successful cases occasionally reported in literature are probably of this class. Drainage of the cisterna magna has not, in a limited experience, come up to expectation, but represents a distinct step in advance toward successful therapy.

Despite the none too encouraging results of the past, the curative treatment of otitic meningitis is only a matter of time. Just as in aviation, the course will be marked by a long line of failures and many fatalities before success is achieved. Its accomplishment will depend in great part on the patience, perseverance, enthusiasm, and co-operation of laboratory workers and clinicians alike, together with earlier operative procedures than hitherto undertaken.

## DISCUSSION OF DR. DAY'S PAPER

By FRED WHITING, M D, NEW YORK CITY

The carefully prepared and exhaustive paper to which it has been our good fortune to listen this evening has thoroughly and dispassionately canvassed the field of *symptomatology and treatment of meningitis*—the most dreaded of all conditions with which otologists have to contend. In opening the discussion of the paper I find little to criticise, less to dispute, and much to commend. Dr. Day is indeed to be congratulated that the conditions of hospital administration in his city are so far in harmony with the spirit of medical and surgical research as not only to permit, but also to encourage, the investigation by autopsy of every case in which surgical procedure has been followed by fatality. For by this means, and in no other way, can we hope properly to interpret our experience, to formulate our observation, and to profit by our failures. The opportunity of following an unsuccessful case to autopsy enables an operator to speak with authority concerning conditions of which his knowledge, in the absence of post-mortem examination, can at best be but *hypothetical and unconvincing*.

Is there a man present here to-night, engaged in active work, who cannot recall at least one case, and probably several, in his practice during the present year (without mentioning the host of similar experiences in years gone by), in which the impossibility of

procuring autopsy has left him entirely in the dark concerning the correct interpretation of conditions of the most vital importance a proper opportunity for the study of which at autopsy might have enabled not only him, but his colleagues as well, to avoid a repetition of similar unfortunate experiences, would also have enriched our knowledge of symptomatology, and would have contributed as well to the unraveling of many a perplexing problem? It is not, gentlemen, as has often been said, from our failures that we should profit most, but rather from a proper understanding of the reason for such failures.

In dealing with the symptomatology and treatment of an inflammatory disease which involves so highly differentiated an organ as the brain and its coverings, we must be prepared to encounter a complexity of symptoms for the interpretation of the vagaries of which the observations of the most experienced surgeons and neurologists will, in many instances, prove a vain reliance, if not at times even a stumbling-block. Many and exhaustive have been the contributions and studies to the subject of the evening's paper, and Dr. Day has, so far as the scope of his paper and the time allotted him permits, weighed and analyzed the various claims to excellence and reliability of those symptoms which occur with sufficient regularity to entitle them to be regarded as classical manifestations of

meningitis. None of these symptoms are new, and but few are the results of recent observation. Their importance as corroborating witnesses or contributory evidence in the syndrome of meningitis has long been recognized and appreciated at its full value. The appearance of many of these symptoms with sufficient distinctness to be clearly and unequivocally demonstrable is in most instances delayed until the disease has reached a stage which precludes the chances of hopeful surgery. The goal for which we are all striving is the discovery of some reliable symptom, either physical or chemical, which shall manifest itself with dependable regularity and at the same time shall appear sufficiently early in the course of the disease to admit of a safe operative procedure for the relief of pressure, before the more serious evidences of meningitis supervene.

The most recent contribution to the study of meningitis which is entitled to receive sober consideration is that of Kopetzky, dealing with the biochemistry of the cerebrospinal fluid in health and disease. This work has been prosecuted with painstaking fidelity and contains much information which must commend it to the conscientious student of meningeal inflammations. It is still much too soon to determine the practical value of Kopetzky's work in its clinical significance, and only extended experience will enable us to ratify or refute the somewhat enthusiastic claims he makes for progressive increase in arterial pressure and the absence of the carbohydrate element from the cerebrospinal fluid with the substitution in its place of nitrogenous products, as reliable indications of the necessity for early brain drainage. The importance of the proposition which he offers cannot well be exaggerated in its bearing upon the possible favorable outcome of operation for meningitis, for should his conclusions prove, upon repeated and impartial trial, well-founded, he will have contributed to our knowledge of symptomatology a discovery of the first importance, and the long-sought early symptom will have been found. But with every desire to be just, and with equal determination to be impartial, the burden of his proof is not yet convincing. Clinical

experience must more fully corroborate laboratory research.

Have we, then, any single symptom, physical, chemical or clinical, occurring sufficiently early in the disease to enable us to make a sure diagnosis of meningitis, while there still remains time to anticipate or forestall by operation the effects of pressure and toxæmia? I have critically perused the literature of meningitis and have listened to the paper of the evening with a mind free from bias and open to conviction, but the closing of the chapter leaves me still unconvinced.

Such surgical procedures as have received the sanction of the medical profession have been given an impartial and intelligent trial in the cases related by Dr. Day, and the results of his efforts are fairly well in keeping with the experience of most operators in dealing with suppurative meningitis. His conclusion, in common with other careful observers of this disease, leads to the conviction that reported cases of recovery from purulent meningitis represent instances of circumscribed rather than diffuse or general meningeal inflammation, and an interesting corroboration of this view is furnished by the recovered case which a year later died and came to autopsy from a reinfection. The post-mortem finding which Dr. Day reports, of the obliterated subdural space and the well-defined area of soldered meninges, was most illuminating and convincing, and corroborates the views that I have always held, namely, that our cases of general suppurative meningitis all die. Whether these unfortunate results are due to our hesitation in operating sufficiently early, or are more properly chargeable to a general inadequacy in the surgical methods employed, or are to be accounted for by the fact that in our keen pursuit of a surgical solution of all the difficulties with which we are contending we have neglected properly to appreciate the necessity of combining measures for the relief of brain pressure with equally important steps for the arrest of the associated sepsis, may provide material for fruitful discussion. However it may be, we are forced to the humiliating acknowledgment that all measures which have up to the present time been instituted



have proved inadequate and most disappointing

A recapitulation of the various remedies and procedures which have from time to time been heralded as possessing curative properties or promising surgical relief would comprise a formidable and uninteresting array, and after each in turn would be inscribed the aphorism, "Tried and found wanting."

Time does not admit of prolonging this discussion sufficiently to enumerate at length the procedures resorted to or the remedies employed in the endeavor to cure meningitis, and indeed any such summary serves only to emphasize the fallibility of our judgment in dealing with this distressing disease. We may briefly mention, as measures which have received the endorsement of the profession but have failed to produce the results expected: ventricular puncture, lumbar puncture, lumbar puncture in combination with craniotomy for through irrigation, laminectomy, and serum therapy. Of the last we need only say that it has accomplished splendid results in cerebrospinal meningitis due to *diplococcus intracellularis*, but its usefulness is limited to this variety of infection for it is effective in no other type of meningitis. Of the other measures enumerated, lumbar puncture has proved the most serviceable for it is an invaluable aid to diagnosis and may even be curative in serous meningitis, but in purulent inflammation of the meninges it offers no rational appeal to our judgment, and as a therapeutic measure is discredited. The internal administration of urotropin or other drugs has not in my experience proved at all satisfactory while the intraspinal introduction of remedies has been either entirely useless or productive of harmful results.

Do we, then, possess at this time any single procedure which, in view of our present experience, may merit unqualified approval? Reluctantly we acknowledge that we know of none. Apparently such relief is still a provision of the future. It would appear that a likely solution of the difficulty may be found in the administration of some autovaccine or antitoxin which will control the toxæmia of the disease, in conjunction with

the particular operative procedure best adapted to relieve pressure in the individual case. However, no one can read the splendid recent contributions of Dr. Haynes to the surgery of meningitis without at least being impressed with the reasonableness of the proposition there advocated.

Dr. Haynes proposes, by opening the cisterna magna, to provide for free and continuous drainage of the infected cerebrospinal fluid, to relieve intercranial pressure, and restore a normal supply of blood to the devascularized vital centers. Drainage from the cisterna magna possesses the great advantage of draining a deep and expansive cavity so situated anatomically and topographically as to offer a natural avenue for the gravitation of intercranial fluids and so favored by its structural conformation as to prevent pressure upon the drains with resulting enveloping adhesions and occlusion of the drainage canal. The situation chosen for this craniotomy also admits of the ready inspection of the foramen of Magendie, and the easy removal of obstructing fibrinous adhesions from this important connecting channel should accumulated exudate offer an obstacle to drainage. Furthermore, Dr. Haynes' operation is free from a complication which constitutes a serious objection to every other procedure which advocates opening the dura sufficiently widely to encourage any reasonable hope of efficient drainage, namely, it is not attended by hernia. The aforementioned advantages constitute in brief the chief arguments in favor of the Haynes procedure. The fact that its performance has not been attended with success should not discredit it. It is on trial, and thus far has not had a fair chance, for it has been undertaken as a last resort in conditions which were in themselves hopeless. As a proposition it is reasonable. As a procedure it is as safe and simple as any expedient which is employed for the relief of conditions of such extreme gravity can be expected to be, and we hope that when instituted early, as its sponsor properly demands, it may prove to be the curative agent for which we have so long and anxiously waited.

PROSTATECTOMY<sup>1</sup>

By E S JUDD, M D, ROCHESTER, MINNESOTA  
Surgeon to St. Mary's Hospital Mayo Clinic

UNTIL within the past few years the perineal operation for removal of the hypertrophied prostate was the operation of choice in many hospitals in this country. As an advocate of this method I would argue, first, that the mortality was less and, second, that the time of convalescence is shorter, since the perineal wound heals much more quickly than the suprapubic. Studying the cases more carefully, however, I have found that the mortality is not directly a result of the operation, but that it depends upon the functional capacity of the kidneys and the condition of the heart and general circulation, which is true with either operation. Our mortality has been greatly reduced by proper preparation of the patient before operating.

For a number of years I have advocated dividing the treatment into two stages.

*First stage.* The first stage consists of relieving the patient of the residual urine, and at the same time treating the cystitis if it exists. Whether it is the mere presence of residual urine in the bladder or whether it is the backward pressure of the urine upon the kidneys which produces the deleterious effect I cannot say, but we are all aware of the harm that may be done by keeping the bladder empty when it has been accustomed to retain even a few ounces of residual urine. The urine which is retained in the bladder should be withdrawn gradually, keeping the bladder empty for a longer period each day until no bad effects are apparent. In many instances it will require several weeks to carry out this treatment, but it invariably results in a most marked change for the better in the general condition of the patient. In about three fourths of the cases the requisite drainage has been accomplished by means of a permanent catheter introduced into the bladder through the urethra. In the remaining one fourth of the cases it

was necessary to make a preliminary suprapubic stab drain, because it was impossible to introduce a catheter or because the urethral catheter could not be worn with any degree of comfort.

*Second stage.* After the reaction due to the withdrawal of the urine has passed, the specific gravity, which invariably falls with the introduction of the catheter, will again come up, and the second stage of the treatment, i. e., the removal of the obstructing prostatic gland, can be carried out. This procedure will be accomplished more satisfactorily and with more safety than if the preliminary treatment had not been instituted.

The functional result as regards the ability of the patient to empty the bladder and, far more important, his ability absolutely to control the flow of urine, is the most important factor in the treatment of these cases. This result is attained in the perineal operation in a large percentage of the cases, but it is quite impossible to determine which will have poor control or which will have complete incontinence. In none of our cases following the suprapubic operation has there been any difficulty absolutely to control the stream, and in practically all of them the bladder can be emptied completely.

The work of Tandler and Zuckerkandl (1) and, more recently, the studies of Lowsley relating to the development of the prostate have shown that the middle lobe is independent and is the one which most frequently undergoes changes in a so-called hypertrophy. Lowsley (2) has shown that the anterior lobe shrinks into insignificance at the twenty-second week, but that this structure may persist throughout life, as is evidenced by the occasional finding of enlarged anterior lobes at autopsy. The same author has also demonstrated that the posterior lobe of the prostate is an independent structure. Its tubules originate from the floor of the prostatic urethra below

<sup>1</sup>Read before the Clinical Congress of Surgeons of North America, New York, November 15, 1912.

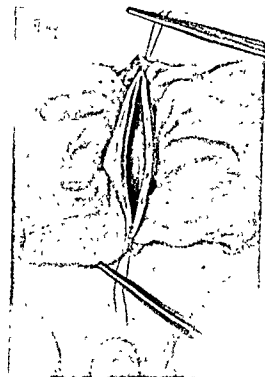


Fig. 1. Bladder lifted out of suprapubic wound by suture in each end of incision. Edges of wound protected by pads of gauze.

the openings of the ejaculatory ducts and are definitely separated from the other parts of the gland. A fibrous capsule intervenes between this lobe and the lateral lobes. In their investigations on prostatic hypertrophy, Tandler and Zuckerkindl did not find the posterior lobe enlarged in a single instance, but found a condition of *pressure atrophy*.

Boyd and Geraghty (3) state that primary carcinoma of the prostate rarely or never begins in any other part than in the posterior lobe. In operating through the bladder this lobe is not disturbed, a point of practical value because of the close relation of this lobe to the ejaculatory ducts. In the ordinary suprapubic operation for a benign hypertrophy the ejaculatory ducts are not injured in any way, and the sexual state remains exactly as it was before the operation.

The chief disadvantage in the suprapubic method is the length of time required for the urinary fistula to heal, due to infection

in this poorly resisting suprapubic space. It has not been uncommon to see these cases drain for weeks or even months, or to see a case terminate badly on account of extensive infection. In every other respect I believe the suprapubic operation is to be preferred, and within the past few years have operated almost entirely by this route. By changing some of the minor points in the technique of the operation I have endeavored to remove the gland with as little chance as possible of infecting the suprapubic tissues. After the gland is removed, the incision in the bladder is drained or closed in such a way that the tissues are exposed as little as possible to infection.

*Technique*—The abdominal incision is made in the usual way and the recti muscles separated. It is much better to make a large incision than to try to work in a crowded space. The fat in the suprapubic space is dissected off from the fundus of the bladder and the peritoneum pushed back. It is very essential that the peritoneum be stripped well back and that the bladder be lifted up as far out of the abdominal incision as possible. I prefer to have the bladder empty, since I have not found it advantageous to fill it with air or water or to open it upon a sound. Ordinarily the peritoneum is not opened, but is stripped back from the bladder. Occasionally, however, the peritoneum will be opened accidentally. This may occur in separating it from the bladder, or it may be done by the pressure used in shelling out a low-lying gland. The first few times this accident occurred I was extremely fearful, but I have now opened the peritoneum in seven cases, each time closing the opening with catgut as soon as it was discovered. In none of these instances did it make the slightest difference in the convalescence of the patient (Fig. 1).

With the fundus of the bladder lifted well out of the abdominal incision the abdominal wound is packed off with gauze, the bladder, which a few minutes before has been cleaned as thoroughly as possible, is now opened by free incision, usually about 2 inches in length. As soon as this opening has been made a supporting suture is passed through each angle of the incision in the bladder and the organ dried by sponging out any accumulated urine or water used in cleansing. It is well at this stage of the operation to examine the bladder for stones or other lesions. This is especially important if it has not been possible to make a satisfactory cystoscopic examination (Fig. 2).

With the gloved fingers of the right hand in the rectum, the gland can be pushed well up into the bladder. The first and if necessary, the second fingers of the left hand are introduced into the bladder. We prefer to start the shelling out of the

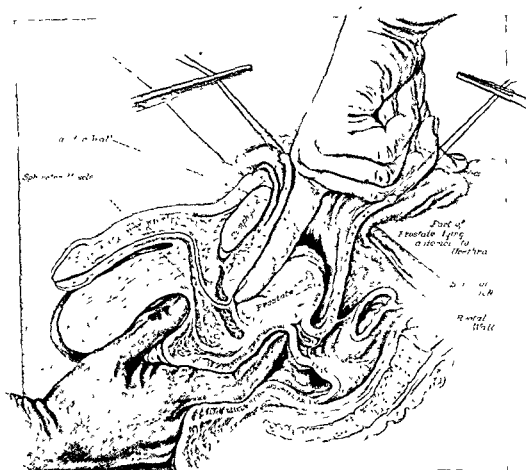


Fig 2 Forefinger of gloved hand in rectum pushing the prostate up into bladder The forefinger of left hand entering prostatic capsule through prostatic urethra (Elaborated from suggestive sketch illustrating "The Choice of Operation for the Relief of Prostatic Dysuria and the Preliminary Treatment Indicated," by Dr Paul M Pilcher *J Mich St M Soc* January 1912)

gland by breaking into the prostatic capsule with the bare finger rather than by using an instrument to cut into it. In some instances, however, especially when a catheter has been used for a great many years, the mucous membrane of the prostatic urethra may have become so toughened that it will be necessary to start the enucleation by cutting through this membrane, since to break through would cause too much traumatism. Ordinarily the finger pushed into the prostatic urethra very quickly breaks into the capsule. Oftentimes on either side of the prostatic urethra, the hypertrophy rounds into the urethra and makes a convenient place to start the enucleation. If necessary, the entire circle of prostatic urethra may be removed. It will reform quickly, and there is no danger of the formation of stricture. On a number of occasions I have removed the entire circle of prostatic urethra.

It is customary, however, to start shelling out the gland at one lateral aspect of the urethra and to terminate at a point about opposite. This saves a strip of mucous membrane of the prostatic urethra running along the dorsum between the bladder and the membranous urethra, and insures against any possible stricture formation. This would seem to be a saving in time for a re-establishment of the entire prostatic urethra. The enucleation should include the entire prostate gland with the exception of the small piece lying in front of the prostatic urethra and the posterior lobe lying behind.

For several reasons it is most important that practically the entire gland be removed, and the fact that the entire gland can be removed by this method is probably one of the best arguments in favor of the suprapubic over the perineal route.

The prostate is entirely surrounded by the fibro-

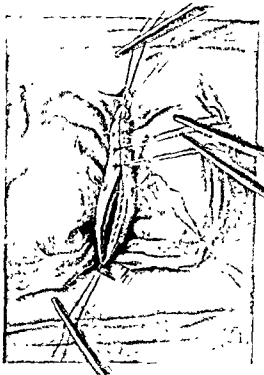


Fig. 3. Bladder supported in wound by traction sutures in ends of incision. Bladder being sutured by interrupted catgut suture. Sutures include all coats except mucosa.

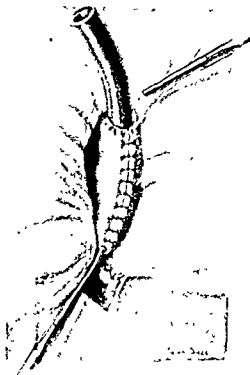


Fig. 4. Showing rubber drainage tube held by purse-string suture in upper end of bladder wound—a method employed when the bladder is badly infected and bleeding seems too free for complete closure of bladder.

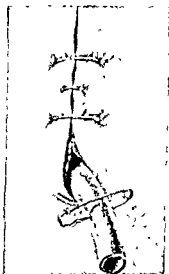


Fig. 5. Showing method of draining suprapubic space when the bladder has been closed completely. Tube is placed in lower angle of wound and extends downward between the recti muscles to the wall of the bladder.

muscular capsule. When the gland has been completely enucleated, the capsule contracts quickly and the hemorrhage stops in a very short time. If however, a piece of the gland be left in the capsule it acts the way a piece of retained placenta acts, i. e. interferes with the contraction of the capsule and thus keeps up the bleeding. The hemorrhages in these crises have been a source of anxiety to surgeons and many devices have been shown to control them. At the present time however, I believe that if enucleation be done within the capsule and the prostate be entirely removed, a gauze pack will seldom be needed to stop the bleeding. Sharp hemorrhage may be caused by dissecting outside the capsule into large vessels or by leaving a piece of the prostate in the capsule. If the enlarged gland be entirely removed, the capsule will contract and the bleeding will be only that which oozes from the edge of the mucous membrane in the urethra and bladder. As soon as the gland is shelled free from its capsule and the urethra is torn off the catheter, which was introduced into the urethra before the operation was begun, is passed through the prostatic capsule into the bladder and irrigation commenced.

The irrigation must be commenced as soon as

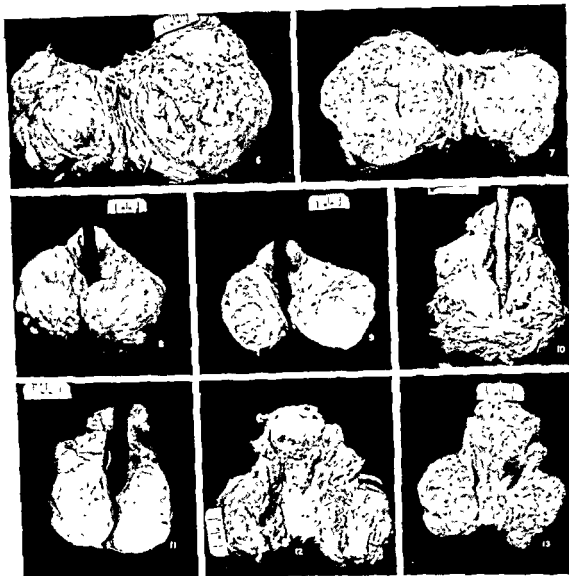


Fig 6 Anterior view of large prostate in which the hypertrophy has produced bilateral enlargement of gland

Fig 7 Section through specimen shown in Fig 6 showing glandular type of hypertrophy with many small cysts in the enlargement seen on left of picture. On the right the enlargement is smaller and contains much fibrous tissue

Fig 8 Anterior view of prostate in which the hypertrophy has produced two lateral enlargements and a small median enlargement. A catheter has been passed through the prostatic urethra. The median enlargement shows in the upper portion of picture behind catheter

Fig 9 Section through specimen shown in Fig 8. Catheter still shows in prostatic urethra. Glandular type of hypertrophy with considerable amount of fibrous tissue and many small cysts

Fig 10 Anterior view of prostate, with two lateral and a median enlargement. Catheter placed in prostatic urethra. In lower portion of picture lateral enlargements are held together by tough fibrous band. Urethra passes beneath band, and opening shows on lower border of picture

Fig 11 Section through specimen shown in Fig 10. Note the narrowed urethral channel which will not permit the passage of catheter. Glandular type of hypertrophy with small cysts and much fibrous tissue.

Fig 12 Anterior view of prostate in which hypertrophy has produced two lateral enlargements and a median enlargement. Obstruction caused by median enlargement.

Fig 13 Section through specimen shown in Fig 12. Glandular type of hypertrophy with many small cysts and small amount of fibrous tissue



Fig 14 Anterior view of prostate in which the hypertrophy has produced two lateral enlargements and a median enlargement. A catheter has been passed through the prostatic urethra. Median enlargement shows above, to left of catheter.

the gland is shelled out, to prevent the accumulated blood from clotting or to wash out the clots which have accumulated in the bladder. The first appearance of clots and blood may give the impression that a sharp hemorrhage is about to occur but if the irrigation be continued a few minutes the flow clears up, and from then on the bleeding will amount

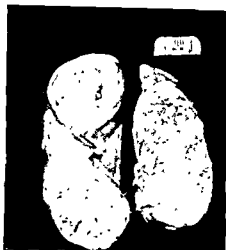


Fig 15 Section through specimen shown in Fig 14. Note tortuous and obstructed urethral channel. Glandular type of hypertrophy with many small cysts.

to little or nothing. Free irrigation is kept up for several minutes, washing through and through the bladder, which is constantly supported as far out of the wound as possible by the sutures in the two angles (Fig. 3). As the irrigation continues interrupted sutures of catgut are placed in the incision in the bladder until the wound is closed. Just before placing the last sutures the finger is introduced into the bladder to make sure that there are no clots



Fig 16 Large irregular shaped prostate which weighed 8 ounces. Hypertrophy has produced two lateral enlargements which projected high into the bladder. Urethral channel passes through bottom of concavity, which shows in upper portion of gland.



Fig 17 Section through specimen shown in Fig 16 (unfixed specimen). Urethral channel passes through bottom of concavity shown in upper portion of the gland. Glandular type of hypertrophy with bulging adenomatous areas.



Fig. 18



Fig. 19



Fig. 20

Fig. 18 A lateral enlargement, from a prostate which has been opened and photographed in uninvolved state. A large adenomatous area has been sectioned and shows in each half. Similar smaller areas also show. In uninvolved specimens these adenomatous areas protrude or bulge outward after the fibrous tissue surrounding them has been cut.

Fig. 19 Small fibrous prostate with slight hypertrophy. Obstruction caused by median enlargement which shows in upper part of picture, behind catheter. A tough fibrous band surrounding urethral canal shows in lower portion of picture.

Fig. 20 Specimen shown in Fig. 19 on section. Dark area in center of picture is prostatic urethra. Median enlargement which caused obstruction shows in upper portion of picture. Glandular hypertrophy with small cysts and much fibrous tissue.

remaining. Should the oozing continue to an extent to clot the urethral catheter while the bladder is being closed a small tube is introduced at the highest point in the incision (Squier) and the irrigation made continuous passing through the catheter and out of the suprapubic tube (Fig. 4). This tube should be sutured accurately into the bladder in the same manner that the tube is sutured into the gall bladder to prevent leakage. As soon as the patient is put in bed, constant irrigation is commenced and kept up until the cleansing water is clear. This will ordinarily take 24, sometimes 48 hours. The tube is then removed. In many of the cases there will be little or no drainage from the wound afterward.

The bladder is washed frequently through the urethral catheter, which is left in place until the wound above has remained closed for several days. When the sutures have been placed in the bladder, if there is no difficulty due to clots and if the cleansing water is returning clear through the urethral catheter the wound in the bladder is closed completely and a small tube introduced to drain the suprapubic space (Fig. 5). If the bladder be completely closed it is necessary to have either a two way catheter for constant irrigation or have a nurse syringe out the bladder every few minutes until all signs of oozing have stopped. In some of our cases there has been difficulty from clots during the first few hours following operation, though usually frequent irrigation and the use of alum water will stop the oozing so that at the end of 12 hours it will not be necessary to syringe out the bladder oftener than once every hour. When the cleansing water returns clear the first catheter is removed, and a clean, sterile one reintroduced. It may require some adjusting to place the catheter in the proper position in the bladder so that spasms will not occur. However the majority of the cases are entirely comfortable with the catheter in position. The catheter

should be changed frequently but should be kept in the urethra until the suprapubic wound has remained entirely healed for several days. This will usually take from two to three weeks. (See Figs. 6 to 20 showing specimens.)

Two or three silk worm sutures are placed in the abdominal wound, the recti muscles being included. The wound is not closed completely. But few of these wounds heal by absolute primary intention, there will be a little serum drainage and in some cases urinary leakage for two or three weeks. I have had a few cases in our clinic in which the suprapubic space became infected in the way that sometimes followed the old method of packing the wound with gauze.

The chief points in favor of this technique in the suprapubic operation may be enumerated as follows: (1) Patients are much more comfortable during the period of convalescence, (2) they do not have to contend with the urine-soaked dressing, and (3) the run of temperature due to absorption from infection in this space is avoided. While these patients require considerable care during the first 24 hours following operation, after that time they are much easier to care for requiring very little dressing.

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## ACUTE PERFORATIVE CHOLECYSTITIS COMPLICATED BY GENERAL PERITONITIS

WITH A REPORT OF TWO CASES

BY CHARLES M. REMSEN, M. D., ATLANTA, GEORGIA

**T**HE comparatively infrequent occurrence of the pathological and surgical condition, acute perforative cholecystitis, as compared with the more common pathological conditions with which one meets in the biliary tract, and its bearing on certain arguments for and against operation on the "acute gall-bladder," warrant consideration of the two following cases:

**CASE 1.**<sup>1</sup> P. S., Polish female, age 45. Five days before admission, was seized with sudden pain in left hypochondrium and back, so severe that patient cried out. Pain passed over to right iliac fossa in 12 hours. Vomiting severe at onset, bile stained, has persisted. Chill lasting one half hour at onset, none since then. Complete anorexia and constipation and increasing abdominal tenderness since then. No bladder symptoms. General condition poor unchanged last three days. Similar attack three years ago lasting only 24 hours. *Examination* W B C 20,000, temperature 103, pulse 132. General condition poor. Jaundiced, bowels not moved by enema. Abdomen moderately distended, especially in lower half. Gastric peristalsis visible. Distinct fullness to right of and slightly above umbilicus, seems to descend with inspiration. Abdominal walls move with respiration. Palpation reveals mass in right iliac fossa, suggesting appendix abscess. In right upper quadrant there is a mass showing outlines similar to an enlarged gall bladder, very superficial and moves with respiration, and extends 11 cm below costal margin in parasternal line. Inner and lower margins fairly definite, outer indefinite due to muscular rigidity, is continuous with liver, and passes up under costal margin. Dull on light, slightly tympanitic on heavy, percussion. Surface irregular, nodular, exquisitely tender. Gas troptosis and gastric dilatation present. Liver dullness reached 1 cm below costal margin. Artificial dilatation of the stomach pushes mass to right. No mass felt on stomach surface. Dilatation of colon demonstrates mass to be in front of this. *Diagnosis* Empyema of gall bladder, carcinoma of gall-bladder, or carcinoma of pylorus with infection.

*Operation* 36 hours later by Dr. Remsen, when permission was gained. Gas anesthesia, right rectus incision. Opening peritoneal cavity revealed a quantity of free greenish turbid fluid. Liver cirrhotic, fibrin over upper surface, mass felt at ex-

amination directly attached to lower border liver in gall-bladder region. Slow blunt dissection revealed perforated gall-bladder, gangrenous in part; perforation partially sealed by indurated omentum and adherent stomach, pylorus, and duodenum. Large amount foul smelling pus evacuated carefully from gall bladder, together with numerous faceted calculi in the bladder and cystic duct (Fig. 1). Cholecystostomy. Drainage. Discharged well ensuing month. Culture taken from free fluid in peritoneal cavity.

**CASE 2.**<sup>2</sup> A. S., Italian male. Onset three days before admission, with sudden acute pain over entire lower abdomen. Nausea, anorexia, constipation immediately set in. Pain persistently and gradually increased, involving entire abdomen, but tenderness has settled more especially in right iliac fossa. Last 18 hours patient has been unable to urinate, last night pain was excruciating throughout entire abdomen. Similar attack three years ago, 15 days in hospital in New York, but refused operation.

*Examination* W B C 14,500, temperature 101. No jaundice. Abdomen slightly and equally distended. Respiratory movements shallow. Deep respiration elicits great pain over lower abdomen. No masses, no peristalsis. Slight bulging in flanks umbilicus normal. Costal margin obliterated. Rigidity over entire abdomen, greatest over lower quadrants. Tenderness everywhere. Most accentuated at right iliac fossa. Deep palpation not possible. Flanks dull. Dome tympanitic. Liver dullness normal. *Diagnosis* general peritonitis. Cause unknown — appendicitis favored.

*Operation* immediately, by Dr. Remsen. Gas and ether anesthesia. Right rectus incision. Opening peritoneal cavity reveals large amount free strongly bile-tinged, purulent fluid. Intestines greatly distended. Appendix presented, adherent. This was excised. Pyloric and gall-bladder region explored. Ruptured gall bladder, surrounded by large amount loosely hemmed-in bile-tinged fluid found. No calculi found. General condition necessitated speed and cholecystostomy performed, protecting and counter drains inserted (Fig. 2). Discharged well at end of four weeks. Culture taken at operation.

In all probability the underlying cause of the perforation was infection, indirectly closing the cystic duct, distending the gall bladder and weakening its wall, and ultimately ending in necrosis of its wall. *Circulatory*

<sup>1</sup>Referred by Dr. Frank Smith<sup>2</sup>Referred by Dr. Ribalte



Fig. 1

disturbances secondary to infection or to the mechanical factors of pressure, and even the direct pressure of the calculi (Case 1), may have been factors in the necrosis as well. Both gall-bladders showed a markedly thickened oedematous wall, the lining mucous membrane being swollen until it resembled a thick red gelatinous coating. The gangrene present in Case 1 was limited to the base of the fundus, and the perforation was situated in the middle of this area. The mucous membrane around this area was intensely inflamed and showed many hæmorrhagic areas. The perforation in Case 2 took the form of a slit along the side of the fundus, and the wall along its borders was similar to the wall of the remainder of the fundus. Faceted calculi in numbers were found in Case 1, whereas in Case 2 none was located after a rapid search. In neither case were there any gross changes suggestive of malignancy.

Inability to obtain more than meagre histories in both cases prevented ascertaining most important guides to the diagnoses. In neither was there a hint of pain in the gall-bladder region before the acute attack. In

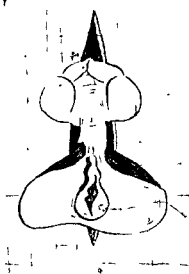


Fig. 2

both, the attacks were ushered in with acute abdominal pain, yet this pain, first felt in the left hypochondrium and back (Case 1), or in the lower abdomen (Case 2), was certainly neither distinctive nor even suggestive of the organ from which the generalized spreading of the infection started. The shifting of the pain and tenderness to the right iliac fossa — an evidence of the action of the mesocolon in guiding fluids from this region along its outer side to the right iliac fossa and pelvis — was evidently due to the continued renewal of infection along the track pursued by the pus and led to a tentative diagnosis of appendicitis (Case 2), where this increased local tenderness was the only distinctive feature in an abdomen generally distended and painful on pressure. In Case 1 the same phenomenon had occurred and the right iliac fossa showed increased tenderness, but here the mass of oedematous omentum partially surrounding and sealing the perforation in the gall-bladder pointed more plainly to the real cause of the flooding of the general cavity.

Before discussing generally the several points of differentiation in such cases, it might be well to tabulate the similarities and dissimilarities of the signs and symptoms of the two concrete examples already mentioned.

	Age and Sex	Duration	Symptoms at onset	Location of pain	Pain	Pain shifted
Case 1	F 45	5 days	Sudden acute pain (abdominal)	Left back Hypocostum	Peristed	To R I F in 22 hours
Case 2	M 21	3 days	Sudden acute pain (abdominal)	Entire lower abdomen	Peristed	To R I F rapidly

	Peritoneal symptoms appeared in	Tenderness greatest in	W. B. C. and Temp.	Toxemia	Operation	Peritoneal fluid	Result
Case 1	last 40 hours	R I F and over whole	20,000 101	Marked	36 hours	Quantity Turbid Green	Base of lungs
Case 2	last 72 hours	R I F	14,000 101	Marked	Immediately	Quantity Turbid Green	Side of Gall Bl.

	Operation	Culture of peritoneal fluid	Gallstones	Gangrene	Sealing peristat	Jaundice	Chills at onset
Case 1	Cholecystotomy	Cultured	Present	Present	Slight attempt	Present	Present
Case 2	Cholecystotomy	Negative	Absent	Absent	No attempt	Absent	None

	General tenderness	Appendix affected	Mass in right region	Diagnosis	Result		
Case 1	Fair	No	Large	Empyema g. b. & gen. peritonitis	Well		
Case 2	Marked	Yes	None	General peritonitis (Appendicitis)	Well		

The problem requiring solution is, whether the condition has originated in the biliary tract or not, and if so, what the nature of the pathological condition is. The points of differentiation must either hinge on the early signs and symptoms, or, when once the general peritoneal signs have overshadowed the local conditions, on various points in the previous history. In the latter, one must search carefully for suggestions of gastric and duodenal ulcer, for indigestion, pain and its relation to the ingestion of food, hyperacidity, hæmatemesis, melæna, gallstones, infection in the biliary tract, Charcot's intermittent fever, chills and jaundice. Lung conditions must be gone into carefully; pneumonia and sub-diaphragmatic pleurisy excluded, as well as heart conditions causing painful liver congestion; intestinal contents examined for a

possible cause of liver abscess or for conditions suggestive of pancreatitis, inflammatory conditions in the appendix—for all these the history must be carefully searched, not so much with the desire to elicit numerous symptoms which may be applicable to any or all of the members of this physiological group but rather to discover some one symptom or set of symptoms which may be particularly characteristic of one certain organ in this group.

Close application to these details may guide us at the time when our difficulties are greatest—at the onset. One must be called upon to differentiate the pain of hyperacidity from the pain of pancreatitis, the pain of pancreatitis from the pain of a leaking ulcer, the pain of gallstone colic from the pain of perforating gall-bladder, and so on throughout the whole list of possibilities in this region.

Careful study of the blood picture, the leucocytes, the temperature, examination of the stools — any of the aids may give us our lead at this critical time when the surgeon must take upon himself the responsibility of deciding whether operation should or should not be performed.

Later the conditions change, and as the signs of early spreading peritonitis appear we are able to rule out many of our earlier possibilities — the heart and lungs are discarded as a cause, the passage of calculi, the acid crisis, must give way to some more definite pathological condition which is resulting in a mechanical soiling of the peritoneum and infection in this cavity. Still we are confronted by various possibilities. Diverticulitis may lead to an extension of the inflammatory process into the surrounding peritoneum, hepatic abscess; perforations of the hollow viscera in this locality; pancreatitis, thrombosis of the mesenteric vessels, even appendicitis and suppurative kidney conditions must yet be excluded as far as is possible by the various signs and symptoms peculiar to them, before a serious consideration can be given to the biliary tract. Tenderness alone should not be relied on, as this may be very misleading, as was seen to be the case in both of our examples. Jaundice is an aid, but actually is present in only a small percentage of the cases. When present, the existence of calculi in the ducts must be considered strongly.

Again, we may find ourselves thrown back upon the previous history, where symptoms of biliary calculi or biliary tract infection — most often not recognized by the patient, and often suggested to us only after some history of "malaria" or "typhoid" has been carefully analyzed — will at least warn us, symptoms which are often similar to and indefinitely overlap those of that physiologically connected group of organs in this neighborhood, but which again, on the other hand, might in a certain proportion of the examples stand out in sharp contrast to the symptoms arising from near-by structures.

Later still, if we are confronted by the consequences of the ruptured gall-bladder where bile has escaped freely into the peritoneal

cavity, our local conditions may be entirely blanketed by the general abdominal signs; and though our indications for operation are definitely outlined, yet we may be entirely in the dark as to the origin of the calamity (unless our previous history is pointed) until the opening of the peritoneal cavity reveals the free bile-tinged fluid nearly always characteristic of a ruptured biliary tract — "nearly always," because in a small number of cases this has existed with the presence of an intact biliary tract so far as could be discovered by the eye.

Operative procedures may frequently require speed, a factor which, if neglected, may be of serious moment to the patient. The appearance of the greenish fluid free in the peritoneal cavity must require immediate exploration of the biliary tract. Chances favor the existence of bacterial inflammation of the peritoneum, since we are dealing with the spontaneous rupture of the gall-bladder. Certainly a potential, if not an actual, peritonitis exists. Having located the perforation as rapidly as possible, a cholecystostomy should be performed. Perhaps the rupture itself may be used as an ostium through which to insert the rubber drainage tube into the gall-bladder. This was done in both of our cases. Protecting and counter-drains are inserted as indicated, and the peritoneal cavity carefully and gently "mopped" out. In a small number of cases, perhaps, cholecystectomy should be considered, especially where gangrene is present, and where the danger, then, of this process extending to neighboring structures exists. Unless especially indicated, it hardly seems reasonable to submit the patient to this more serious operation, except when his condition is such that one feels no alarm as to the outcome.

Finally, it should be borne in mind that acute perforative cholecystitis, though rare, does in fact exist, and the possibility of this condition operates strongly against following any fixed rule designed to permit attacks of acute inflammation of the gall-bladder to subside without operative interference, and should place greater responsibility on the surgeon who is watching such a case. The infrequency of this condition should not allow

one to dismiss it, in differentiating those early cases where perhaps pain in the right upper quadrant is the only predominating symptom, nor should one forget, in those frequent cases with which one meets, after all local signs have been far overshadowed by the subsequent peritoneal inflammation, that the

gall-bladder, as a causative factor, must be reckoned with seriously.

I wish to thank Dr. William S. Halsted for his kindness in allowing me to report these two cases, which occurred while I was in his service at the Johns Hopkins Hospital as resident surgeon.

## POST-OPERATIVE RESULTS OF AMPUTATION OF THE CERVIX<sup>1</sup>

FROM THE GYNCOLOGICAL CLINIC OF THE JOHNS HOPKINS HOSPITAL, BALTIMORE

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**A**MPUTATION of the cervix was probably first advised by Ambroise Paré, and, about a century later, by Tulipus of Amsterdam—1652 Osiander, in 1802, performed the operation several times. Later, the operation was given considerable repute throughout France by Lisfranc, Duputren, Récamier, Hugier, and others. During the first half of the nineteenth century, the operation was practiced almost exclusively for carcinoma of the cervix. The amputation was performed by means of the bistoury and écraseur, the raw cervical stump being allowed to heal by granulation. In 1887, Byrne introduced a method of amputation with the electrocautery. His method had a great vogue, particularly in France, and great stress was laid upon its special efficacy in malignant cases. Sims, in 1861, introduced the first plastic operation on the cervix, advocating the use of a vaginal cuff of mucous membrane to cover the stump.

Operative interference for the common pathological conditions of the cervix, such as chronic endocervicitis and laceration, only came into general use during the latter decades of the past century, mainly through the work of Sims, Emmet, Hegar, Simon, Marckwald, and Schroeder, and later, through Pouey, Pozzi, Jayle, Simpson, and many others. The various procedures introduced by these surgeons gave rise to a rather extensive literature between 1885 and 1900,

in which the relative merits of each method is discussed at considerable length. Before long, however, two methods gained prominence over all others. Throughout Europe, Schroeder's operation soon came into general use, while Emmet's trachelorrhaphy became the method of choice throughout England and America.

Between 1890 and 1900, there appeared a number of articles and monographs, for the most part of French or Italian origin, reporting the post-operative results of amputation of the cervix. A number of cases of dystocia, due to post-operative cicatricial stenosis of the cervical canal, had been reported, some due to amputation of the cervix, others to cauterization. Likewise an increased liability to abortion and premature labor, following the former procedure, had been pointed out.

Ducasse in 1889, concluded that amputation of the cervix interferes in no way with the normal course of pregnancy or with the dilatation of the cervix during labor, but admitted that in the event of post-operative cicatricial stenosis, consequent upon an atypical operation, obstetrical complications might ensue. Pescher, in a monograph published three years later, admits that the occurrence of premature deliveries may be somewhat increased after the operation, but that ordinarily the normal course of pregnancy is uninterrupted. Contrary to Ducasse, however, Pescher states that after Schroeder's

operation the majority of cases are attended by serious difficulty during labor, due to the inelastic quality of the cervix. On the other hand, Pedobedoff, in 1895, concluded that after this operation pregnancy progresses normally, and labor is unattended by difficulties, qualified by the statement, however, that in certain cases dilatation of the cervix may be somewhat retarded and that the incidence of premature delivery may be slightly increased. Martin, in his monograph published ten years later, reporting numerous cases, states that post-operative cicatricial rigidity of the cervix may be the cause of serious obstetrical mishaps to both mother and child. Likewise Audebert in 1898, in a monograph entitled 'Pregnancy and Labor after Amputation of the Cervix' insists that the operation exercises a marked influence upon, firstly, the duration of subsequent pregnancies, in causing frequent abortions and premature deliveries, and secondly upon parturition, by the frequent occurrence of premature rupture of the membranes, and in certain cases by causing cicatricial stenosis of the cervical canal. He admits that the latter complication is only liable to follow an atypical operation. Nevertheless, Pozzi states that none of the divers operations on the cervix compromise the ability of that organ to dilate readily, but give rise merely to innocent cicatrizations which in no way render the cervix less elastic. Numerous observations, he says, have proved that neither sterility nor dystocia need be feared while de Koninck refers to this opinion as one of "exaggerated optimism." He makes no mention of the question of premature delivery. Likewise, La Torre, another Italian author, is flatly in favor of the operation in all cases, stating that no evil consequences need be feared provided accurate approximation of vaginal and cervical mucosa is obtained. Quite in accordance with these authors are Doléris, Challeux-Vivie, Morisani, and Pichevin while Duponnois, in a monograph published in 1901, even concludes that, following amputation of the cervix, labor is merely rendered shorter and easier. On the other hand, Lepage, Pinard, Tarnier, Boudin, McPherson, Flandrin, Porak, Potocki, Fabre,

Taurin, Caillon, Dumouly, and others have discussed the possible obstetrical consequences of the operation from the opposite viewpoint. Guibout, in an extensive monograph published in 1900, concludes from a careful analysis of 145 cases that the liability to abortion and premature delivery is increased after cervical amputation, and that serious dystocia may result, but that the operation undoubtedly augments the liability to subsequent impregnation.

Just lately, the controversy seems to have been dropped entirely, practically nothing having been written on the subject for several years while the field of dissension has meanwhile been left deserted for complete occupation by the enthusiastic advocates of the operation. The assertion seems justifiable that, almost without exception gynecologists, in this country at least, regard amputation of the cervix as an operative procedure free from subsequent complications, barring, perhaps, the occasional occurrence of post operative hæmorrhage. Yet it would seem, from a consideration of the report to follow, that this operation, though often the procedure of choice and of incontestable value in many cases cannot be indiscriminately practiced without the occurrence of subsequent obstetrical consequences more or less serious.

At Dr Kelly's suggestion I have prepared an analysis of the post-operative histories of the cases of amputation of the cervix performed in the Gynecological Clinic of the Johns Hopkins Hospital, with the object of determining, first, the efficacy of the operation as a curative procedure, and second, its effect if any upon menstruation, impregnation, pregnancy, and parturition. Of the circular letters sent out, 128 replies were received which were complete enough to include in this report.

#### METHOD OF OPERATION

Almost without exception, a high amputation had been performed, from  $2\frac{1}{2}$  to 3 cm. of the cervix above the external os being removed. The operative procedure in these cases may be given as follows.

The cervix being exposed by the introduction of a posterior retractor, it is grasped with tenaculum forceps and drawn well down towards the vaginal outlet. A circular incision is then carried com-

pletely around the cervix at a level about 1 to  $1\frac{1}{2}$  cm above the external os. The cuff of vaginal mucous membrane thus released, together with the bladder, is then dissected well back, and the amputation completed at a point  $2\frac{1}{2}$  to  $3\frac{1}{2}$  cm above the external os. The bleeding is then controlled and approximation of vaginal and cervical mucosae obtained by the introduction of interrupted sutures of formalin catgut, the needle being introduced at the periphery and carried through the cervical canal. In a few of the cases, the typical "cartwheel" closure was done. In most of the cases, a special suture was taken at the lateral angle, the vaginal cuff being turned out and the edges approximated anteroposteriorly, either with a figure of eight suture or with a special suture now used extensively in this clinic, namely, beginning at the periphery anterolaterally the needle is introduced to come out at or near the cervical canal and is introduced again at a point just below this to come out posteriorly at a point on the periphery opposite the original point of entrance. This suture controls hæmorrhage at the lateral angles remarkably well, and at the same time gives very good approximation of the edges of the vaginal mucosa.

#### A — IMMEDIATE POST-OPERATIVE RESULTS

In six of this series of cases, or 46 per cent, post-operative hæmorrhage occurred severe enough to necessitate the removal of the patient to the operating room for resuture of the bleeding cervix.

There seems to be no time, however indefinite, during the patient's convalescence at which this complication may be expected. In only one of the six cases did the hæmorrhage take place on the day of operation. In one case the bleeding came on the second day, and in another on the third day. In the other three cases, severe hæmorrhage occurred at a time when the ordinary case is considered out of all danger — one on the ninth day, another on the eleventh, and a third on the twenty seventh day after operation. A careful review of the operative notes and post-operative observations by the ward doctor in these six cases reveals nothing to account for the complication in any instance.

In three cases hæmorrhage occurred soon after operation and was due in all probability to insufficient or faulty suture of the cervix. By bearing in mind the following points, cases of early hæmorrhage could be largely avoided:

1. Great care should be taken to tie the cervical branch of the uterine artery which

runs along each side of the cervix quite superficially. A good plan is to tie these off, high up, as soon as the vaginal cuff has been dissected back — a procedure which materially reduces the bleeding during the operation.

2. The radially placed sutures should be of strong, twenty-one-day catgut, formalized or chromicized. The use of plain catgut for these sutures, as practiced in some clinics, is dangerous.

3. Care should be exercised not to tie the sutures so tightly as to cause strangulation of tissue and consequent sloughing.

Why serious hæmorrhage should occur several days, or even weeks, after operation, rather than within a few hours, seems at first difficult to explain. It is inconceivable that thrombosis should not ensue, even in the largest cervical vessels, within a day or two at least. For late post-operative hæmorrhage another explanation must be found, and infection seems to be the only one likely to adequately account for the complication. The existence of a low grade or latent endocervicitis in cases coming to operation for cervical disease is very common, indeed almost the rule. Amputation, or any other surgical procedure upon the cervix, certainly tends to enliven such chronic infections, a fact well evidenced by the profuse leucorrhœa which usually follows for a period of several weeks. It is not unlikely that such an infection might in certain cases open up a vessel some time after operation and cause sharp hæmorrhage.

It is evident that the operation as ordinarily performed is not without considerable danger when we consider that in nearly five per cent of the cases severe post-operative hæmorrhage may occur, and this long after careful watching for such a mishap is considered necessary, or even after the patient has been discharged.

#### B — REMOTE POST-OPERATIVE RESULTS

1. *General health.* In all but 13 cases of this series, amputation of the cervix was combined with some other operation. In comparing the patient's general health before and after amputation of the cervix, it is, of course, necessary to consider the part played by any other operation, simultaneously per-

formed, in improving the patient's general condition. For this reason, the cases were divided into three groups, according to the operation: 1. Those cases in which an amputation of the cervix alone was done, 2. Those in which the repair of a relaxed vaginal outlet followed; 3. Those cases in which the abdomen was opened. The result, as shown by the following tabulation, is striking

#### EFFECT OF AMPUTATION ON GENERAL HEALTH

Group	No Cases	Improved	Same	Worse
1. Amputation alone	13	12 or 92%	1	0
2. With penneorrhaphy	67	60 or 90%	5 or 8%	2 or 3%
3. With abdominal section	48	43 or 90%	2 or 4%	3 or 6%

About 91 per cent of the entire series of 128 cases reported noticeable improvement in general health. In only 8 cases, that is, 6½ per cent, was there no change in the general condition, while 5 cases, or about 4 per cent, reported subsequent impairment of health. In view of the fact that amputation of the cervix was the only operation performed in all the cases, it seems somewhat significant that in each group about 90 per cent reported improvement. The percentage in each group being so constant it is perhaps not unreasonable to assume that the operation common to all of them was, at least, largely responsible for the change, particularly when we consider that 92 per cent reported improvement where amputation of the cervix was the only operation performed. Duponnois (1901) concludes that amputation of the cervix, even when unsuccessful in curing an old endocervicitis, is followed by a diminution in leucorrhœa and a general betterment of the patient's health. On purely theoretical grounds, ample justification may be found for such an assumption. The beneficial effect of the removal of such foci of chronic infection as the tonsils, the appendix, or even the radical cure of an oral sepsis, has been incontestably proven. Reasoning by analogy, why should not the removal of the uterine cervix, so often the seat of chronic infection, have a similarly beneficial effect upon the patient's condition?

2. *Leucorrhœa* Of the 128 cases analyzed, 109 cases, or 85 per cent, had leucorrhœa before operation. Sixty-eight cases, or about 62½ per cent, of the group reported themselves entirely cured of it

Thirty-three cases, or 30 per cent, reported noticeable improvement.

Eight cases, or 7½ per cent, reported the leucorrhœa unimproved, while one case declared it to be worse since operation.

Almost without exception, the patients left the hospital with some vaginal discharge.

In 42 cases, or 38½ per cent, the discharge disappeared or underwent marked improvement within one month.

In 24 cases, or 22 per cent, the same results were obtained within two months, making a total of 60 per cent of the cases cured or improved within two months.

In 13 cases, the discharge lasted about six months, while in 6 instances, it lasted nearly a year. In 3 cases, the leucorrhœa endured more than two years, and then stopped entirely in 2 cases and underwent marked improvement in the other. In but 9 cases, or about 8¼ per cent, was there no improvement in this respect. A review of the operative notes of these 9 cases yielded nothing to account for the failure of the operation to cure the leucorrhœa, except in one instance where a particularly low amputation was done.

In view of the fact that of the 109 cases, 92 per cent reported either cure (62 per cent) or marked improvement (30 per cent), amputation of the cervix would seem to be an admirable method of combating persistent leucorrhœa of cervical origin.

3. *Menstruation* The effect of amputation of the cervix on subsequent menstruation is marked in one respect, namely, the occurrence of menstrual pain. So far as this series of cases shows, there is no effect upon either the frequency of menstruation or upon the amount or character of the menstrual flow, yet Dr. Russell tells me that in a few of his cases, marked menstrual irregularities following the operation have occurred.

The incidence of menstrual pain before and subsequent to operation is shown in the following tabulation of the 109 cases, which could be used for studying this question. The cases have been divided into three groups, according to operation, the same classification being made as above when considering the effect upon the general health.



### OCCURRENCE OF MENSTRUAL PAIN BEFORE OPERATION

Group	No Cases	Pain	None before nor after operation
1 Amputation alone	11	8 cases	3 cases
2 With perineorrhaphy	5*	47 cases	10 cases
3 With abdom. section	41	17 cases	4 cases

### OCCURRENCE OF MENSTRUAL PAIN AFTER OPERATION

Group	No Cases	Less Pain	No change	More pain
1 Amputation alone	8	4 or 50%	4 or 50%	None
2 With perineorrhaphy	4	25 or 62½%	17 or 30%	5 or 10%
3 With abdom. section	3*	25 or 62½%	6 or 16%	6 or 16%

It will be noted that in Group 3 the percentage of the cases reporting decreased as well as increased menstrual pain is higher in each case than in either of the other two groups. This is more or less to be expected, as will be appreciated by a glance at the following table, showing the type of abdominal operation done in the cases of Group 3

#### ABDOMINAL OPERATIONS IN GROUP 3

Suspension and appendectomy	41 cases
Myomectomy	7 cases
Removal of one tube or one ovary	4 cases
Removal of both tubes	1 case
Ligation of both tubes	1 case
Cholecystotomy	2 cases
Nephrectomy	1 case
Hysterotomy	1 case

Of the six cases in this group complaining of increased menstrual pain after operation, a ventral suspension of the uterus and appendectomy were performed in three cases, a modified Gilliam suspension of the uterus and appendectomy in one case, and a myomectomy in two cases.

To sum up 17 cases of 109 analyzed had no pain during menstruation either before or subsequent to operation—a number which seems very small when it is considered that almost without exception these women were multiparae. Of the 92 cases remaining, 54, or nearly 59 per cent, noticed marked reduction in menstrual pain subsequent to operation. No change is reported in 27 cases, while 11 patients declared their menstrual pain to be decidedly increased. Of this last group, 6 had had abdominal operations.

Whether the reduction of menstrual pain in the 54 cases observed can be partially attributed to amputation of the cervix may be somewhat questionable. Some observers have attributed menstrual pain to cervical lacerations in certain cases, and,

granting that in certain cases of Group 3 the decrease was mainly due to the suspension of a retroflexed uterus, it may be again noted, as when considering the effect upon the general health, that a rather remarkable constancy exists in the percentage of cases reporting improvement in each of the groups. As before, it may not be unreasonable to assume that the amputation of a diseased cervix was the main factor in effecting this result, the operation being the only one common to all the cases.

4 *Influence of amputation upon the occurrence of subsequent pregnancy.* Many pathological conditions of the uterine cervix have long been pointed out as causes of sterility. Cervical stenosis or atresia, hypertrophic elongation, and acute antelexions or retroflexions are among the mechanical obstacles to the spermatozoa which have received much attention. Again, in chronic endocervicitis, the secretion of the infected cervical gland has often been demonstrated to be a material extremely inimical to the activity of the sperm, while the impenetrable plug of mucus which is often found in the cervical canal in these cases has been noted by Guibout, among others, as a mechanical obstacle of some importance. When sterility exists in the presence of such manifest causes, the logical procedure, amputation of the cervix, at once presents itself.

Lutard says, "Since Sims, the treatment of sterility in the female is rather surgical than medical," while Champetier de Ribes, Scanloni, Sims, Simpson Pozzi, Guibout, La Torre, Barnes Mangin, Morisani, Duponnois, Pescher, Doléris, and many others have furnished evidence of the truth of this statement by the report of hundreds of cases of sterility cured by amputation of the cervix alone. All are agreed that in certain cases amputation of the cervix is the procedure of choice.

For the purpose of studying the influence of this operation upon the occurrence of subsequent pregnancy, the cases were divided into two classes.

A Comprising all married women under 40 years of age at the time of operation, who are menstruating regularly now.

B. Including (1) women over 40 years of age at the time of operation; (2) cases who have passed or are at present in the climacteric; (3) cases of double salpingectomy.<sup>1</sup>

In the first group there were 72 cases — women in whom the occurrence of pregnancy would naturally be expected. Yet of this number but 14 reported the occurrence of subsequent impregnation — about 19.4 per cent. In view of the observation of Mangin (1895), who, in following 44 cases reported subsequent pregnancy in 26, these figures seem very low. On further analysis of the 72 cases of Class A, however, a few facts were brought out which make the results somewhat less disappointing.

In the first place, 34 cases of the 58 in Class A remaining sterile after operation were operated upon during the past three years, and therefore can hardly be considered sterile yet. To state this consideration differently the average time of operation among the 14 cases reporting pregnancies is 6 years ago while the average time of operation in the sterile group of 58 cases is but 3 years 8 months ago. In other words, the group of 58 cases so far remaining sterile since operation should be allowed 2 years 4 months more before the results could be absolutely compared. Secondly the average age of those women who became pregnant was, at the time of operation 28 years 4 months, while the sterile group averaged 4 years 2 months older.

It is of considerable interest to note that 10 of the 14 cases reporting fertility, or about 70 per cent, have had two or more pregnancies since operation. Of the remaining 4 cases, 3 were operated upon recently, one each in 1908, 1909, and 1910. The fact that a large majority of the fertile cases had two or more pregnancies after operation, while 80 per cent of the 72 cases of Class A remained sterile (although 90 per cent of the latter were multiparæ), would naturally lead to the assumption that in the latter group there exists some condition in the cervical stump, such as

<sup>1</sup> I have not considered ligation of the Fallopian tubes a sufficient cause to classify these cases in the Class B, mainly because a letter unintentionally sent to a case in which ligation of both tubes followed a trachelectomy was returned with a description of the normal pregnancy and delivery which occurred a year later.

stenosis, rendering conception very unlikely. There can be no doubt that stenosis, and even complete atresia of the cervical canal, occasionally follows amputation of the cervix. Several such cases have been reported associated with hæmatometra, and we have very recently seen an example in this clinic. Should stenosis of the cervical canal occur commonly after this operation, we would expect precisely the results obtained by an analysis of the cases here reported, namely, a large percentage of sterile women and repeated pregnancies in the fertile group. The reason for this is apparent. Given cervical stenosis, conception is less likely, and the percentage of sterile women rises. Should pregnancy occur in spite of the stenosis, the subsequent delivery, even though premature, would probably dilate the narrowed cervical canal sufficiently to render the occurrence of a second impregnation much more likely. On the other hand, should there be no stenosis following operation, there would be, of course, nothing to interfere with repeated pregnancies.

Theoretically, it would seem likely from the results obtained that at least a narrowing of the external os commonly occurs after amputation of the cervix, whether due to the healing together of the puckered edges of the vaginal cuff about the external os or to subsequent iris-like cicatricial contracture in the cervical stump.

Pozzi, La Torre, Morisani, and others have laid great stress upon the prevention of cervical stenosis following the operation by careful approximation of the vaginal and cervical mucosæ, in order to obtain healing per primam and thus avoid the formation of a cicatrix. Cases presenting cervical stenosis after operation, they attribute to poor operative technique. Yet it is difficult to understand how a vaginal cuff of mucous membrane measuring several centimeters in diameter can be "accurately approximated" to a cervical canal measuring but a few millimeters in diameter. Raw edges of puckered vaginal mucosa are certain to be clustered about the periphery of the newly formed external os, even though the lateral angles of the vaginal cuff be turned outward (away from the canal

by special suture) a procedure which markedly diminishes this effect. When the cervix is pushed back into place and a vaginal pack introduced, it would seem very likely that in a large percentage of cases healing together of the raw edges of the vaginal mucosa about the external os would ensue, thereby diminishing its calibre. Likewise, the contraction of the cicatrix following the operation, whether healing has been by first or second intention, can be but in one direction — towards the cervical canal. Any scar tissue caused by the operation must in contracting be comparable to the action of the iris, narrowing the cervical canal much in the same way as the latter narrows the pupil.

It is questionable whether these objections to the operation itself would hold if one should employ a very simple but effective procedure which Dr. Kelly has used for some time. Instead of completing the amputation on a plane perpendicular to the long axis of the cervix, a wedge-shaped piece of tissue is removed laterally, on each side of the cervix, so that when vaginal and cervical mucosæ are approximated, a wide, smooth external os is formed, rather than the usual narrow, slit-like aperture almost hidden by the puckered edge of the vaginal mucosa about it. The method is comparable to "cupping" the cervix, as practiced after a supravaginal hysterectomy, so that it may be better closed over. The danger of narrowing the cervical canal by the operation should be further avoided — first, by the introduction of a cervical drain of rubber or protective, to be left in place for a week or more following operation, to prevent healing of the edges of the vaginal cuff; and secondly, gentle dilatation of the cervical canal some months afterward, a procedure which could be easily accomplished without the use of an anæsthetic, and which would remedy any narrowing of the cervical canal which might have taken place.

It must be admitted that the value of the operation in certain cases of persistent sterility is incontestable, yet it appears that the procedure as ordinarily performed is often the cause of that very condition. Much attention has been paid in the literature to cases

of sterility cured by the operation, while the numerous multiparæ (80 per cent) who remain sterile subsequently have been practically ignored.

5. *Frequency of abortion and premature delivery following amputation of the cervix.* The incidence of abortion and premature delivery is admitted by practically all observers to be considerably increased after amputation of the cervix. Guibout, stating that abortion probably only follows an amputation improperly carried out, nevertheless admits that they occur with a frequency which is hardly negligible, while Ducasse, La Torre, and Morisani reach the same conclusion. Pescher concludes that the operation distinctly favors premature dilatation of the cervix, and agrees with Pedobedoff that the incidence of premature delivery may be increased, while Audebert and de Koninck are less conservative, declaring that the operation exercises a marked influence upon the course of subsequent pregnancies by causing very frequent abortion and premature delivery. Nevertheless, Bernheim concludes, from an analysis of forty-nine cases, that abortion is not more frequent, and that when it occurs, causes other than the operation can be found.

The results obtained by an analysis of the 14 cases of this series reporting pregnancy after operation are quite in harmony with the conclusions of Audebert and de Koninck. Ten of the 14 cases, or about 71 per cent, had one or more miscarriages following the operation, while 5 of the cases (36 per cent) had premature deliveries, varying from the sixth to the eighth month.

We would expect a high amputation of the cervix to increase the liability of a subsequent pregnancy to end before term. In only one of the 14 cases, was more than 3 cm. of the cervix removed. This case had two children afterwards, both at full term, and no miscarriages or premature deliveries, being one of the 3 cases in which each pregnancy occurring after operation went on to normal completion. In each of the other 13 cases, from 2½ to 3 cm. of the cervix was removed, which is as high an amputation as is usually done.

¶ In order to appreciate the effect of the operation more fully in this respect, it is important to compare the marital histories of these cases before and after amputation of the cervix.

Previous to operation, these 14 cases had had a total of 52 pregnancies. Twelve of these ended by miscarriage (23 per cent) and one by premature delivery (2 per cent), making a total of 25 per cent ending before term.

After operation, these same women reported a total of 32 pregnancies. One of these has not as yet terminated, so cannot now be considered. Of the remaining 31 pregnancies, 11 terminated by miscarriage (35½ per cent) and 6 by premature delivery (19 per cent), making a total of 55 per cent of the pregnancies occurring after operation prematurely interrupted, as compared with 25 per cent before operation. Similar results are obtained by Audebert, who reports 16 cases, collected mainly from Pinard's clinic. Before operation, his cases had 22 deliveries at term and 5 before term. After operation, these women had only 5 full-term deliveries, as compared with 19 pregnancies which ended prematurely. In the following tabulation, these results show up somewhat more strikingly.

#### COURSE OF PREGNANCY BEFORE AND AFTER AMPUTATION OF THE CERVIX

A	Before operation (Audebert)	No Cases
	Delivery at term	22, or 82%
	Interrupted before term	5, or 12%
	After operation (Audebert)	
	Delivery at term	5, or 21%
	Interrupted before term	19, or 79%
B	Before operation (J H Hosp)	
	Delivery at term	39, or 75%
	Interrupted before term	13, or 25%
	After operation (J H Hosp)	
	Delivery at term	14, or 45%
	Interrupted before term	17, or 55%
	Now Pregnant	1

It will be noticed that, in the cases from this clinic, 25 per cent of the pregnancies before operation terminated prematurely. It might be argued that the high percentage of miscarriages following the operation is due largely to the fact that these particular cases had a habit of aborting, which seems true. Nevertheless, it cannot be denied that the

operation more than doubled their proclivities in that direction. Again, the objection might be raised that some of the other operations simultaneously performed on these cases account in a measure for the large number of subsequent miscarriages. It happens that in this particular series such an objection is easily answered.

1. In 2 of the cases amputation of the cervix was the only operation done, while in 6 instances, a repair of a relaxed vaginal outlet followed.

2. In 5 cases, the abdomen was opened. In each of these, a suspension of the uterus and appendectomy only was done. Every one of the five have had one or more full-term children since, although only 8 of the 14 cases had normal pregnancies. It cannot be argued, therefore, that the high percentage of miscarriages following the amputation is due to the abdominal operation. If due to the operation at all, the cervical amputation must be the cause.

The results obtained by this analysis, as well as the observations of numerous authors who have discussed the subject, conclusively prove that in the event of impregnation following this operation, the chances of a normal completion of the pregnancy are markedly diminished. Advocates of the operation attribute such results, as well as any other unpleasant sequel of this procedure, to poor operative technique, but the constancy of the results obtained by so many competent operators easily disposes of such an explanation. According to the cases reported above, *a pregnancy occurring after amputation of the cervix has not more than an even chance of progressing to term.*

6. *Amputation of the cervix as a cause of subsequent dystocia.* The question of the influence of amputation of the cervix upon subsequent parturition seems to have attracted more comment in the literature than any of the other numerous objections to the operation. Before the introduction of plastic methods, the cervical stump was left uncovered, to heal by granulation. The large, firm cicatrix resulting must have invariably been a cause of serious dystocia in the very occasional cases becoming pregnant after

such a procedure. Since Sims (1861) introduced his method of covering the cervical stump with vaginal mucosa, such crude methods have been abandoned, but the occurrence of dystocia following various plastic operations on the cervix is, according to many authors, very common.

Pinard states that "in destroying the continuity of the tissues of the cervix one invariably obtains a cicatrix. This cicatricial tissue may be the cause of pathological rigidity at the time of labor." Guibout concludes that, following the operation, dystocia may reach any extreme and may be the cause of death of both mother and child. According to Martin, cicatricial rigidity may account for serious obstetrical mishaps, while Pedobedoff states more conservatively that dilatation of the cervix may in some cases be delayed at the time of labor. Pescher even insists that it is exceptional for the dilatation of the cervix to progress normally. On the other hand, Duponnois concludes that the operation merely renders labor shorter and easier, yet, to quote Tarnier and Boudlin, "in these serious cases of sclerosis in which the cervix is inelastic parturition by the natural route is most dangerous," indicating the frequent necessity for Cæsarean section.

Pozzi, La Torre, Pichevin, Doléris, Bernheim, Morisani, Ducasse, Chaleux-Vivie, and others attribute such results to poor operative technique. Doléris even reports 78 cases (operated upon by himself) without the occurrence of dystocia in a single instance. Referring to Pozzi's statement to the effect that none of the various operations now practiced on the cervix compromise its elasticity, de Koninck says, "This opinion is one of exaggerated optimism" while Audebert and Guibout seem to agree with him. On the one hand are cases reported by Lepage, Toledo, Martin, Fabre and many others as terminating by miscarriage, premature delivery, an obstetrical operation, or even rupture of the uterus, yet enthusiastic advocates of the operation assure us that no such unfortunate sequelæ are to be feared.

Of the 14 women of this series who became pregnant after operation 11 had children at term or at the eighth month. A report

from these cases on the delivery of the first child after operation shows that 7 of the 11 cases (64 per cent) experienced serious dystocia. The other 4 cases had easy labors.

Audebert states that, following this operation, premature rupture of the membranes is of common occurrence, while de Koninck, Guibout, and others are of the same opinion. Unfortunately, the data as regards the incidence of this complication are lacking in this series of cases.

It is evident, from a consideration of the foregoing discussion, that dystocia commonly follows amputation of the cervix. It is unlikely that this, as well as any of the other objections to the operation, can be adequately explained on a basis of "imperfect operative technique." Too many surgeons whose ability cannot be questioned have obtained such results to admit of such an explanation.

In conclusion, I wish to thank Dr. Kelly, chief of this clinic, at whose suggestion this work was undertaken and under whose direction it was completed. Also, to Dr. Wm. W. Russell, I wish to express my appreciation for many valuable suggestions.

#### CONCLUSIONS

In view of the results obtained by the analysis of the 128 cases reported, it may not be unreasonable to draw the following conclusions:

1. Hemorrhage after amputation of the cervix is not uncommon (5 per cent), and may occur weeks after operation.

2. Cases of late post operative hemorrhage are due to infection rather than faulty suture of the cervix.

3. After amputation of a diseased cervix, 90 per cent of the patients show noticeable improvement in general health.

4. Persistent leucorrhœa of cervical origin is cured in 60 per cent of cases and improved in 30 per cent.

5. About half the cases experience less menstrual pain after the operation.

6. Four fifths of the women remain sterile after operation, yet in certain selected cases of persistent sterility amputation of the cervix seems to be the only practicable procedure.

7. This post-operative sterility is probably mechanical in origin, and may be due either to a narrowing of the external os through encroachment by the edges of the vaginal mucosa or to a stenosis of the cervical canal, consequent upon the iris-like contraction of the cicatrix which invariably follows the operation.

8. A pregnancy following amputation of the cervix has not more than an even chance of progressing to full term, in which event

9. Serious dystocia due to cicatricial rigidity of the cervix will commonly be encountered

10. Amputation of the cervix is the operation of choice in elderly women, but the procedure should be applied to those in the child-bearing period only when more conservative methods of treatment, such as Hunner's linear cauterization or thorough curettage of the cervix, have failed

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## PRIMARY TRAUMATIC DORSAL COMPLETE RADIOCARPAL DISLOCATION<sup>1</sup>

WITH REPORT OF A CASE

By A MERRILL MILLER, M D, DANVILLE, ILLINOIS

**T**HIS luxation is rare. Its marked infrequency is the principal reason for its presentation. The literature shows there are fewer than forty authentic cases. This list is growing slowly. Considering the completeness of records in most of our large hospitals, and the light shed upon doubtful bone lesions of the wrist by the Rontgen ray, one must admit the list is not large.

The absence of a uniform classification compels us to admit to the bibliography certain articles having to do with the wrist joint, e g, luxations of the wrist, dislocation of the radius, and carpal displacements may contain references to the lesion in question. But, from title alone, all do not specify backward displacement, and this fact may be given a minor part in the report. Even at the risk of criticism, all references are included which might in any way contribute to the subject. Classifications always vary with the personal view of the author and current surgical usage. Reports are often scant in detail as to anatomical location, the complication of

fractures, or break in the integument. Any attempt to classify other than along the broadest lines may omit reports germane to the subject. Many texts give a mere outline without comments. At best the discussion is brief.

Considerable doubt was formerly expressed concerning even the existence of this lesion, until accumulated clinical evidence was corroborated by the X-ray. Conscientious and well-informed surgeons took different views and exhibited much spirit in their support. A very vigorous dissenter was no less an authority than Dupuytren (28), who said, "I had always found these supposed dislocations of the wrist turn out to be fractures, and in spite of all which has been said upon the subject, I have never met with or heard of one single well-authenticated, convincing case of the dislocation in question." Certainly a clear-cut statement which leaves no doubt as to his individual opinion. Dupuytren, however, was denied the ocular proof of exactness furnished by the X-ray. With such teachers and surgeons as Smith, Nelaton, and Cooper

<sup>1</sup>Read before the *Academy of Medicine of the Wabash Valley, Terre Haute, Indiana*, May 26, 1911. I was assisted by Dr Carl H. Von Klein in looking up the literature and bibliography.

clinical observation and deduction had reached a high degree of excellence; but after all an individual opinion could not be checked by any final and conclusive method of examination. Reports do not state in every instance that the dislocation was dorsal, on the other hand, they omit saying it is not.

The age at which dorsal dislocation occurs is strikingly in favor of young male adults. From the list of cases it is evident they occur in those mostly exposed to acute traumatic injuries. Schroeter (59), reviewing the traumatic luxations of the wrist, says, "Luxations occur mostly in children where anatomical conditions are most favorable." In only one case in which the age is recorded is this injury found above thirty years — report made by von Brunn (11). From the nature of the injury and character of the displacement, the lesion must be one due to a severe, usually quick, traumatism. The screw-like action in cases reported by Rydygier (57) and Cameron (14), in which the elbow was in a fixed position against a solid wall with a dorsally flexed hand against a moving wagon, affords an opportunity to study in detail one mechanism of displacement.

While by far the majority of dorsal dislocations occur without a break in the integument, numerous instances are recorded — Chassaignac (17), Couteaud (22), Hecht (35), Korte (41) — in which a protrusion of the arm or wrist bones took place. This compound injury is often followed by an infection in either bone or synovial membrane, with a corresponding tardiness in recovery.

Before the advent of the X-ray, wrist lesions of all varieties were recognized only by clinical signs, with the exception of a few cases in which post-mortem examination (61, 67), or operation (17, 20, 23, 27, 42), confirmed the diagnosis. Those in which resection was necessary should be cautiously admitted under this classification. A radiograph in addition to the history is necessary to make the diagnosis positive, and removes at once all doubt as to the condition present.

The lesions likely to be met and excluded are: (a) Barton's fracture; (b) separation of the radial epiphysis (17); (c) luxation of the carpus; (d) the carpus upon the meta-

carpal bones; (e) Colles' fracture. Dorsal luxation bears but a superficial resemblance to this fracture, and if one keeps in mind the styloid processes confusion should not occur. This displacement offers little difficulty of diagnosis, is simple in reduction, and satisfactory in results.

The manner of production is not uniform, except it is due to direct violence. Authors give contradictory causes as producing the same deformity. Case reports of dorsal dislocations in which the hand was bent dorsally have been made by Bays (5), Cooper (18), Hecht (35), Moriarity (51), Delorme (24), Given (31), Korte (42), Couteaud, and Rydygier (57). Exactly the same lesion has been reported due to volar flexion by von Brunn (11), Sir Astley Cooper (18), and Roland (56). Wyeth (68) recognizes this but cites no cases. Cotton (19) says, "That falls upon the back of the hand should cause this . . . is hard to understand." From this evidence we must not conclude that it has a single cause.

Mechanically, it seems to me, the most favorable position for backward displacement obtains when the hand is dorsally flexed and the fingers are partially contracted, claw-like. Given these conditions, the volar tendons act as a skid and elevate the carpus out of the radial socket. *Spasmodic contraction of the forearm muscles maintains the deformity.* Without fracture, crepitus is absent.

Dorsally the articular surface of the carpus is palpated just under the integument and proximal to the styloid processes of radius and ulna. These landmarks are found in their proper relative position under tightly drawn skin, and are continuous with the shafts of their respective bones. This essential point in differential diagnosis is readily determined. The rounded carpus, as well as the concave articular surface of the radius, is somewhat masked by tightly stretched tendons.

Again, luxation is exactly at the radiocarpal joint. The prominence is abrupt. The deformity is angular. It is strongly marked, and greater than in other injuries in this region. Swelling and hæmorrhage are absent. Hæmorrhage not only means bleeding between the bone fragments, but into the neighboring



structures as well. The hand is on a plane parallel with, but posterior to, the forearm. This position of the hand must raise the dorsal tendons from their attachment to the radius. The fingers assume a position of semiflexion. Anteriorly, the volar ligament is ruptured; the lateral as well (13).

Almost without a dissenting phrase clinicians and writers are agreed that simple dorsal dislocation is readily reduced with or without anaesthesia, by traction and pressure upon the carpus. The bones tend to assume their normal relation when muscular spasm has been overcome. Difficulty in reduction should excite suspicion of some complication or error in diagnosis. When replacement has been made, there is but little tendency to recurrence unless the luxation is partial. This security is due to the character of this joint and the strong natural splints in the tendons. Of some comfort, both to surgeon and patient, I find no instance mentioned of permanent disability to the wrist.

#### REPORT OF A CASE

**History.** On August 10, 1910 a young male adult F. W. M., age 31, while attempting to start the motor of a large automobile felt a sudden sharp pain in the region of the right wrist. The operator was pushing down upon the starting crank which was about horizontal center. The line of resistance was against the palm when the flexors were partially contracted, the hand being slightly flexed dorsally, the direction of force against the palm being similar to a fall upon the outstretched hand. The wrist was a fixed point, the palm distally being movable offered ideal conditions for dorsal luxation of the carpus.

**Examination.** Superficially it resembled a Colles'. By more careful inspection the carpus was found to override the dorsal aspect of the radius. Measurements from the prominent tumor (the carpus) posteriorly to the end of the middle finger were exactly the same as in the normal hand. All passive movements painful. Styloid process of both radius and ulna normally located. Crepitus absent. Reduction under ether by slight traction upon the hand and pressure over the tumor. No tendency to become displaced. **Light fixation splint.**

**X-ray examination.** Taken fifteen hours after the injury, and shows all bones in their normal relation; also a fissure fracture extending one third way across the radius from the medial side. Styloid process intact.

Passive motion given at intervals until the fourteenth day, when all dressings were removed. Good result.

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## THE PROGNOSTIC VALUE OF THE LEUCOCYTE COUNT IN PELVIC SUPPURATIVE CONDITIONS<sup>1</sup>

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SOME time ago, a patient was admitted to Lakeside Hospital presenting definite indications of bilateral purulent salpingitis. Yet this woman did not appear very ill, her pain was not severe, there was no distention; the temperature, which after admission had never been above 99.8° F., was quite normal before operation. Her pulse and her general conditions were practically normal. Nevertheless she pre-

sented a leucocytosis of about 16,000, and this fact rather worried us. We were still more worried when, after operation, she developed a generalized peritonitis, with a temperature of 104.8° F. and a pulse running up to 176. Prompt drainage was instituted, and she got well, but this experience, combined with others of a similar if less striking nature, has led us to dread operations upon suppurative cases which present high leucocyte counts,

<sup>1</sup>Read before the Clinical and Pathological Section of the Cleveland Academy of Medicine, April, 1912.

even when unaccompanied by severe clinical symptoms.

Such experiences causes us to inquire somewhat more closely into the relation of preoperative leucocytosis to post-operative recovery. It is, of course, generally conceded that, in a rough sort of way, a relatively high, as opposed to a low, count indicates the presence of pus, a poorer walling-off, a more virulent organism, or a more acute stage of the disease. The question for solution is, whether this higher count can be utilized in estimating beforehand the possibilities of the spreading of the infection after the operation. Is the degree of leucocytosis, as an indication of the gravity of a given case, to be put on a par with the temperature, the pulse, and the general clinical symptoms? And when these various factors disagree, is it wise to be influenced by the leucocytosis more, or less, than by the fever and other signs and symptoms? In the text-books, no satisfactory answers to these questions are to be found. Of course, all state that a high count indicates pus, but the general opinion seems to be that the count in pelvic cases is quite variable -- that large amounts of pus may occur with quite low counts, while little or no pus may be found in cases in which the leucocytes are most numerous. The books generally state that the leucocytosis is largely controlled by factors which we cannot accurately measure, such as the sterility or virulence of the pus, the completeness of the walling-off, the nature of the organism involved, and the opsonic index of the patient's blood. Without more exact knowledge of these points (they say) it is impossible to estimate correctly the value of the leucocyte count obtained, and the implication is that the count itself is of little value in such pelvic suppurative conditions.

The questions I propose are "Are the leucocytes themselves a measure of the virulence, the walling-off, etc.?" "If so, do they offer a good method of measuring the very factors which determine why one patient gets well with rapidity and ease after her operation, whereas another has a very tedious or even precarious convalescence?"

In endeavoring to arrive at a solution of

these problems, one hundred cases have been tabulated from the records of Dr. Robb's service at the Lakeside Hospital. These cases were taken absolutely at random: a certain number of volumes of the histories were taken haphazard, and all the suppurative cases recorded in those volumes were abstracted. In order to eliminate as far as possible the personal element in the leucocyte counting, volumes of the histories were taken with dates as widely separated as possible, so that the counts of many different house surgeons might be included. Otherwise, there was absolutely no selection of cases. All pelvic pus cases, which later were submitted to a laparotomy and in which a preoperative leucocyte count was recorded upon admission, were thus tabulated, up to a total of one hundred cases.<sup>1</sup>

It may, of course, be objected that accurate results cannot be obtained by thus throwing together a number of widely different suppurative conditions -- that, for example, it is impossible to compare a simple gonococcus pyosalpingitis with a big streptococcus abscess following an infected labor. But the point is that frequently a preoperative diagnosis as to etiology and the extent of the disease is impossible, and we are taking all these cases together, to see if the leucocytes can help us in the many instances in which the other prognostic facts are lacking or incomplete. For that reason, we have tabulated chiefly those facts that can always be learned about any patient -- temperature, pulse, vomiting, and the like; and upon such facts we base this comparison.

To those interested in the leucocytosis in gynecological cases, the inaugural dissertation of Otto Pankow, Jena, 1904, is of special interest. In Dr Pankow's group of pelvic pus cases, however, the counts ran much lower than ours at Lakeside, only few of his cases presenting a leucocytosis above 9,000. Apparently, I may add, all his patients recovered uneventfully.

Regretting the necessity of presenting to you tables of dry figures, I have tried to make them as short as possible; and so we have been forced to divide the cases into groups of

<sup>1</sup> I might mention that it is our practice to defer operation in such cases till the acute stage has passed.

"high" leucocyte counts and "low" leucocyte counts; "high" fever and "low" fever, etc. The figures shown as the dividing lines between these groups of "high" and "low" may seem to be picked rather arbitrarily, but they are as near the fair mean as possible.

The numerical average of all the hundred leucocyte counts was 16,200. The highest count was 38,000; the lowest, 5,700. As 14,000 divides all the cases into two roughly equal groups, it was chosen as a standard. Thus a "high" leucocyte count means one of 14,000 or over; while a "low" count is one below that figure. Similarly, a temperature of 101° F. or over is called "high" for the purposes of this tabulation. A pulse above 120 at any time after the effects of the anæsthetic were over is also referred to as "high."

Let us, therefore, consider all the cases which, on admission, had counts of 14,000 or over, and contrast them with those showing less than 14,000 leucocytes. The group of "high" counts includes 53 cases, that of the "low" counts, 47. The percentages mentioned, of course, belong to the particular group referred to, not to the whole hundred cases.

	High— 14,000 or over	Low— under 14,000
Maximum temperature above 101° F. after operation 12	75%	40%
Maximum pulse over 120	66%	34%
Febrile more than 10 days	81%	23%
Mortality, exclusive of deaths on table	11%	0%
Drainage required in	45%	15%

Let us now contrast, in a similar manner, the group of cases which presented both a high leucocyte count and a high fever with the group of cases in which both temperature and white cells were low. There were 24 cases in the former group, and 33 in the latter.

	High—Fever 101° or over, leucocytes 14,000 or over	Low—Fever below 101°, leucocytes below 14,000
Post-operative temperature above 101° F.	75%	40%
Post-operative pulse above 120	71%	25%
Febrile more than 10 days	79%	12%
Mortality	16%	0%
Drainage required	50%	6%

These figures are just about what one might have expected, but the important comparison comes in regard to the groups in which the

leucocyte count and the fever do not tell the same story. When we first see our patient and find a high leucocyte count combined with a low fever, or vice versa, upon which finding can we place the greater dependence in making our prognosis? Thus we take two groups: In the first—which includes patients with leucocytes over 14,000 at admission, but with a temperature constantly below 101° F. previous to operation—we find a total of 27 cases. The other group embraces 16 cases, in which a leucocytosis of less than 14,000 was combined with a fever that went above 101° F. before the operation.

	High—Leu- cocytes 14- 000 and over, fever below 101°	Low—Leu- cocytes be- low 14,000; fever 101° or over
Post-operative temperature over 101°	81%	42%
Post-operative pulse over 120	67%	48%
Febrile more than 10 days	93%	36%
Mortality	8%	0%
Drainage required	44%	42%

These figures are certainly suggestive. Certain other facts are interesting also. Serious complications developed in seven of our hundred cases. These included general peritonitis, broncho-pneumonia, suppuration of the incision, and acute pericarditis. Of these seven patients, only two had a preoperative temperature of more than 101° F.; whereas, with but a single exception, they all showed a leucocytosis above 14,000. Four patients required secondary operations for the evacuation of septic fluid. Two of these four had preoperative temperatures below 100° F., but the leucocyte counts ranged from 15,000 to 36,600 upon admission.

One other comparison might be of interest—that of the outcome of the ten cases showing the highest white counts, as contrasted with the ten cases showing the highest preoperative fevers. The high white counts range from 28,000 to 36,000; while the high fever ranges from 102.5° F. to 104° F.

	Ten highest leucocyte counts	Ten highest fevers
Average preoperative leucocytes	32,500	16,630
Average preoperative temperature maximum	101°	103°
Average highest post-operative tem- perature	104.1°	102°
Average highest post-operative pulse	148	132
Average days febrile	28	14
Percentage mortality	30	20
Percentage required drainage	80	50

A word about the mortality. Six of our hundred patients died. Three died of general peritonitis, in from five to eight days after operation. Two died of general septicæmia, in 28 and 33 days respectively. One died of pyæmia. The preoperative temperatures ranged from 99° F. to 103° F., but the lowest leucocyte count in our fatal cases was 19,000, the others ranging from 20,000 to 33,600 upon admission.

Leaving aside, for the time, our series of one hundred cases, I find that a total of ten deaths have occurred in Dr. Robb's service following laparotomies for pelvic suppurative conditions, in which an admission white count is recorded. The preoperative maximum temperatures ranged from 99° F. up only 50 per cent being above 101° F. On the other hand, but two white counts were below 19,000 on admission. Of these two patients, one died of shock upon the table, and so does not come into our account; the other, with a count of

11,000 died of general septicæmia after 25 days, so that only 10 per cent of the fatal cases showed a low count.

#### CONCLUSIONS

- 1 The leucocyte counts in pelvic suppurative conditions are extremely variable.
- 2 In a series of 100 such cases, the leucocyte counts were decidedly of more prognostic value than the preoperative temperatures.
- 3 With pus in the pelvis and a leucocytosis above 14,000, some trouble arose during the convalescence in a majority of our 100 cases.
- 4 With pus in the pelvis and a white count of less than 14,000, trouble developed during the convalescence in only a small minority of our 100 cases.

I wish to express my indebtedness to Dr. Robb for his kind permission to use the records of his service at the Lakeside Hospital, and also for his interest and help in this work.

## GOITER AND ITS RELATION TO ITS STRUCTURAL AND PHYSIOLOGICAL UNITS<sup>1</sup>

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THE evolution of our knowledge of the subject of goiter may be briefly stated to have begun with the recognition of four clinical facts, i. e., the presence of a tumor of the thyroid gland; the presence of a condition called myxœdema, which was found in association with changes in the gland, a condition known as cretinism, which was associated with thyroid changes, and a clinical complex in association with protrusion of the eyes and enlargement of the gland. Clinicians, surgeons, chemists, hygienists, pathologists, physiologists, embryologists, and zoölogists have endeavored, disconnectedly, to understand the conditions and their etiology.

Experimental surgical experience may be briefly summarized from the beginning of the unsatisfactory efforts of Schiff (1884) at

transplantation of thyroid tissue after thyroidectomy. Bircher (1890) tried the effect of trans-planting thyroid tissue into a myxœdematous patient. His efforts were followed by good but not perfect results. Horsley (1890) transplanted the thyroids of monkeys and sheep without striking results. The imperfect results of these experiments were considered to be due probably to the method of transplantation. Von Eiselsberg, therefore, acting upon this supposition, transplanted the thyroid into the abdominal wall of thyroidectomized animals. His work led him to say that further work would be necessary before definite conclusions could be made. Payr (1906) transplanted the thyroid into the spleen in thyroidectomized animals without great practical results. Other experimenters have repeated these experiments

with results which merely demonstrate the essential nature of the organ to animal economy and the relative value of transplantation to therapy.

Partial thyroidectomy in goiter in the hands of Kocher, Mayo, Halstead, Crile, and others has given sufficient empirical satisfaction in the human being to demonstrate its necessity in the treatment of the clinical conditions, which have not responded to any known hygienic, medical, or serum treatment.

A knowledge of the chemical nature and the supposed active principles of the thyroid extends back to a period several years before animal experimentation upon the thyroid came into use. The iodine content of the thyroid was known to Oidtmann (1858), and the water supply of regions of endemic goiter and cretinism were studied by Chatin (1859). The work of Baumann (1896), however, demonstrated that iodine was a normal constituent of the thyroid and was present in larger proportions than in other organs of the body. From his work detailed studies have developed upon this constant constituent with the discovery of its incorporation with protein cellular constituents. The iodized proteid was given the name "iodothylin" or "iodothyro-globulin." The essential nature of the gland and the chemical findings gave rise to speculation, which led to various theories, namely, the "secretion theory" (Baumann, Ross, Oswald, and others), the "neutritization theory" (Notkin and Blum), and the "biological reversion theory" (MacCarty).

The whole experimental work which has been done upon the thyroid, especially the work upon extirpation and transplantation, has apparently demonstrated the essential nature of the organ to economy. It has led to the use of thyroid extract with effective results in cases of apparent thyroid insufficiency. It has led the surgeon to more accurate surgical procedure, and has enabled him to empirically cure many patients and relieve many others. Hygienists and clinicians have advised change of drinking water and environment, meat-free diet, rest, iodine, belladonna, and special sera, with the result that no recognized specific is apparently known, at least not practiced.

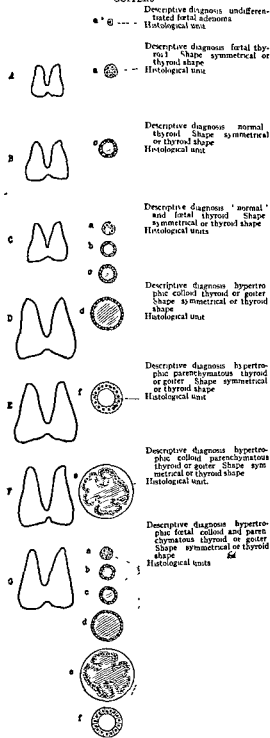
The pathologist has been willing to classify the conditions into types by means of a terminology, which is indefinite, semi-clinical, un-descriptive, and extremely varied. Zoologists, embryologists, and physiologists have not had the economic importance of the condition impressed upon them sufficiently to make them devote large amounts of energy and time to the evolution of the organ and its normal function.

After an extensive review of the literature upon the subject and in the presence of accepted facts, namely, that the function of the thyroid is unknown, the etiology of pathologic conditions in and associated with the thyroid is unknown; that therapeutics of goiter, as practiced, is empirical; that clinical pictures and pathologic terminology are confusing, and that the condition is of economic importance, the most important question which arises is, in the writer's opinion, simply; what are the actual anatomico-pathologic conditions which are found in the thyroid gland?

This question may seem superfluous, indeed academic, in the presence of the extensive descriptions in journals and text-books. The writer's experience, however, with over three thousand fresh specimens, which were removed at operation, prompts a confession of inability to group his material into and according to the published classifications and terminology which have been thus far presented.

Pathological diagnoses which are dictated by clinical diagnoses are easily made. Diagnoses such as "colloid goiter," "exophthalmic goiter," and "foetal adenoma" are very simple, but they are much simpler than the conditions which are actually present. If, however, progress is to be made in scientific medicine, independent observations must be made by the pathologist, who is uninfluenced by clinical dictation. It is his duty as a scientist, in conditions as chaotic as the subject of goiter, to record what he sees and not to make diagnoses. Correlation may be made after sufficient embryological, anatomical, zoological, clinical, chemical, and therapeutic data are obtained. With this independent attitude toward pathologic con-

## SYMMETRICAL OR THYROID SHAPED THYROIDS OR GOITERS



ditions, it has been found that the material which has been removed in St Mary's Hospital has presented the following facts.

The specimens themselves, as they came immediately from the patient, formed two large groups, namely, the symmetrical or thyroid shaped group (Fig 1) and the asymmetrical or nodular group (Fig 2). Such grouping has absolutely no apparent direct relation to the activity of the gland. It is merely the result of the structural arrangement of the glandular units and their supporting structures. Analysis in the mechanical sense results in the realization that any gland is a system which is composed of units.

The fetal thyroid is symmetrical or thyroid shape, and is composed of histological units, formed of groups of four to six epithelial cells, which are arranged to form an acinus. An acinar lumen is rarely seen in the fetal thyroid. This type of acinus constitutes, physiologically and histologically, the differentiated thyroid, and differs from the normal adult thyroid only in size and the absence of an acinar lumen.

The post-natal thyroid is symmetrical, and is composed of acini or glandular units, which have lumina surrounded by low cuboidal cells. The lumina are filled with a so-called "colloid" substance. All acini of such a thyroid are not of the same size although the variation is within small limits. One not infrequently finds a thyroid which has the microscopic appearance of an adult normal thyroid (B). The acini, however, vary in histological characteristics from that of the fetal thyroid (A), to and including the acini of the normal adult thyroid (B). The thyroid may be described as a post natal "normal" and fetal thyroid (C).

The three conditions (fetal thyroid, normal thyroid, and post-natal normal and fetal thyroid) just described may be considered "normal" in the light of our present knowledge, although the fact that all the surrounding glandular tissue of adenomata resembles the condition which is seen in the post-natal "normal and fetal thyroid" may serve as a guide to prove the origin of adenomata in embryonic irregularities in differentiation or reaction to normal stimuli.

## ASYMMETRICAL OR NODULAR THYROIDS OR GOITERS

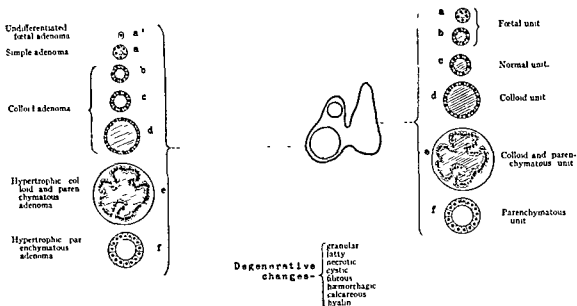


Fig. 2.

The symmetrically hypertrophic thyroid, which is seen by the surgeon as goiter, presents definite macroscopic and microscopic pictures, which may be grouped under four headings. This grouping may be done purely upon a histological basis.

The simplest hypertrophic thyroid, *hypertrophic colloid thyroid* (D), consists of acini, which are larger than one finds in the "normal" thyroid. They are readily visible grossly and contain glistening colloid. The condition is apparently a diffuse or general reaction to some stimulus. Such thyroids have been removed in cases with a symptom complex which has been clinically taken to be mild "hyperthyroidism." In most of such cases some small amount of hypertrophic and hyperplastic cells are often found. This gland corresponds to the condition which Marine has called the cured gland, the condition which occurs experimentally after the administration of iodine. Whether such a specimen has passed through the histological picture of marked epithelial hyperplasia is impossible to determine with our present material and methods. It leads up to and is not definitely marked off from the third

hypertrophic gland in the diagram, i. e., *hypertrophic colloid and parenchymatous thyroid* (F).

Before considering this combination gland, however, the *hypertrophic parenchymatous gland* (E) should be described. Grossly it is a meaty symmetrical thyroid. Histologically one deals with an acinus which varies in size but which is usually small, more often about the size of the normal acinus, but which is composed of hypertrophic or hyperplastic cells, which surround a lumen which is usually not filled with "colloid" material. The fourth hypertrophic symmetrical thyroid is composed of acini (a, b, c, d, e, f) which are represented in all of the foregoing thyroids. Such a specimen may be descriptively called a *hypertrophic, fetal, colloid, parenchymatous thyroid* (G).

All the pathologic conditions of the gland which come under the heading of goiter do not allow the gland to retain its original shape. Asymmetrical or nodular glands, which comprise the second group (Fig. 2), contain usually, if not always, one or more encapsulated oval or round adenomata. These vary greatly in size and number. They may be milli-





mally with a patent duct or analogous organ. Whether this animal is aquatic, terrestrial, or both is, so far as the writer knows, still undetermined.

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ABDERHALDEN'S BIOLOGICAL TEST FOR PREGNANCY<sup>1</sup>

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THIS test is based on the assumption that a protein that is foreign to the blood will cause the development in the body fluids of an enzyme capable of splitting such foreign protein. In pregnancy, according to Abderhalden's observations, the placenta causes the appearance in the mother's blood of such foreign protein and, indeed, as has been shown by Veit, Schmorl and Weichard, chorionic cells may occur in the maternal circulation. The ferment having the power to destroy such placenta protein can be demonstrated by allowing a small amount of serum to remain in contact with peptone prepared from placenta or with a preparation of the boiled placenta itself. By the first method, the changes in the optical characteristics of the fluid, due to the transformation of peptone into amino-acids, are recognized by the polariscope; by the second method, the transformation of the protein of boiled placenta into peptone or amino-acids is recognized after dialysis by certain color reactions applied to the dialysate.

The first or optical method presents difficulties which detract from the use of the test as a ready clinical method, the method of preparing the placenta peptone is time-consuming, difficult and not always successful; a special, and therefore expensive, type of polariscope is needed, and except in expert hands the readings are difficult. This work was begun with the intention of using the optical method, but as so many difficulties were encountered in its use as a clinical method, it was abandoned temporarily in favor of the dialysis method. The latter, with the use of the biuret test, as first announced, also has its difficulties, which, as will be shown, are due mainly to the unreliability of color reactions and the uncertain personal equation in the reading of the same. The dialysis method promises, however, to be the simpler and the more satisfactory, and therefore, with a proper color reaction, possible of universal use. Recently Abderhalden has recommended in a supplementary publication the use of a new color test, dependent on the use of triketohydrindenhydrat (Ninhydrin), and this we

<sup>1</sup> From the John Herr Musser Department of Research Medicine, University of Pennsylvania, and the Obstetrical Service of the Hospital of the University of Pennsylvania, aided by a grant from the Committee on Scientific Investigation of the American Medical Association.

have found to give more exact results than does the biuret.

#### METHODS

Briefly, the technique as recommended by Abderhalden is as follows:

**Preparation of the placenta.** The fresh placenta, after the removal of the membranes and cord, is cut into pieces the size of a quarter. These are placed in a dish and washed with running water to remove as much blood as possible. The placenta is then placed in 2 litres of water to which 2 drops of acetic acid have been added and is boiled for one minute. This water is then decanted or filtered and the coagulated pieces of placenta are again placed in water containing acetic acid and boiled again for five minutes. The water is tested for the biuret reaction (to 10 cc of water add 5 cc of 33 per cent NaOH, shake well and stratify with a 0.4 per cent  $\text{CuSO}_4$  solution). The reaction should be negative, that is free of all soluble protein, if all the instructions are properly carried out. If the reaction is positive the water must be changed again. After a negative reaction has been obtained, chloroform and toluol are added to the water and placenta and the mixture is transferred to a wide-necked bottle well stoppered. This material will keep indefinitely.

**Preparation of serum.** The serum is obtained by venous puncture in the usual manner under aseptic precaution. It must be absolutely free from haemoglobin. Abderhalden states that 2 or 3 cc are sufficient, but in this investigation it has been found advisable, for the purpose of adequate control tests, to have at least 5 or 6 cc.

**Dialysis.** The diffusion membranes of Schleicher and Schull are the most satisfactory. All membranes should first be tested as to the impermeability of each to egg albumen or blood serum, and their permeability (by using 0.1 per cent Witte's peptone) to peptones. This is very important. In such a tested membrane place about 1 gm. of the finely divided coagulated placenta tissue. To this add 1.5 to 2 cc of serum. Wash the outside of the diffusion membrane with water to make sure it contains no particle of placenta tissue or blood serum. Place the membrane in a small beaker containing 20 cc of water. The level of the liquid outside the membrane should be about the same as of that inside. Cover both with toluol and keep at a temperature of 37° C for 16 to 24 hours. Control tests with serum alone and with placenta alone should always be made.

**Color reactions.** If the biuret test is to be used a portion (10 cc) of the dialysate is placed in a test tube, and 5 cc sodium hydrate (33 per cent) is added and a layer of 0.4 per cent cupric sulphate carefully superimposed. A violet to violet-purple ring indicates a positive reaction.

If the triketohydrindenhydrat test is employed the following steps are necessary. Take 10 cc of the dialysate (avoid including toluol) and add 0.2 cc of a 1 per cent watery solution of triketohydrinden-

hydrat, heat quickly, and boil for exactly one minute. If the reaction is negative the solution remains colorless or turns light yellow. In a positive reaction a deep blue color appears immediately, or sometimes only after standing awhile.

As this work was started immediately after Abderhalden's first communication, we have followed his improvements in technique as they appeared, thus using first fish-skin membrane sacks and the biuret reaction, later the Schleicher and Schull diffusion shells and the biuret reaction and finally the triketohydrindenhydrat color test. The difficulties which were encountered in the earlier work were so many and so great that it seems worth while, in view of the fact that others may have encountered them to present them in some detail. This is done advisedly, for several times our difficulties were such as to suggest the advisability of dropping the work entirely, but now that the technique has been mastered it may be well to state the difficulties and the measures necessary to overcome them.

In the first few experiments following Abderhalden's original method fish-skin membranes were used as diffusion sacks. At the outset of a large number examined only a few were found which did not leak after immersion in water for a few hours, many others were found to be leaking at the end of the 24 hours necessary for the test. A small number, however, survived the preliminary tests with 0.1 per cent peptone solution and normal serum respectively and such were used in a small number of tests with sera from four women in the eighth and ninth months of pregnancy. In these the biuret reaction was used. No consistent results could be obtained and the fish-skin membranes were therefore abandoned and Schleicher and Schull diffusion shells used instead. At first the larger and thicker shells (No 579 35 mm in diameter) were employed, but as they proved unsatisfactory the thinner shells (No 570, 16 mm. in diameter) were substituted. The smaller shells are more easily handled in that smaller containers may be used.

After testing these shells against peptone and normal blood serum<sup>1</sup> the work was continued with the biuret reaction as an indica-

<sup>1</sup> About 20 per cent were found permeable to serum proteins.

tor. At first the time of incubation was 16 to 18 hours, but following a later technique published by Abderhalden the time was extended to 24 hours. The results follow:

TABLE I—DIALYSIS METHOD WITH BIURET REACTION

No	Month of Pregnancy	Serum <sup>1</sup>	Serum plus Placenta	Placenta	Aq Dist	Peptone 0.5 Per cent
1	Eighth	—	+	—	—	+
2	Ninth	—	+	—	—	+
3	Seventh	+	+	—	—	+
4	Ninth	—	+	—	—	+
5	Sixth	—	+	—	—	+
6	Ninth	—	+	—	—	+
7	Seventh	—	+	—	—	+
8	Eighth	—	+	—	—	+
9	Seventh	—	+	—	—	+
10	Ninth	—	+	—	—	+
11	Eighth	—	+	—	—	+
12	Ninth	+	+	—	—	+
13	Ninth	—	—	—	—	+
14	Eighth	+	+	—	—	+
15	Seventh	+	+	—	—	+
16	Eighth	—	—	—	—	+
17	Ninth	+	+	+	—	+
18	Day of delivery	—	+	—	—	+
19	Day of delivery	—	+	+	—	+
20	Day of delivery	—	+	+	—	+
21	Day of delivery	—	—	+	—	+
22	Delivery	—	—	+	—	+
23	1 day post partum	—	—	—	—	+
24	Toxemia sixth	+	+	—	—	+
25	Eclampsia, seventh	+	—	+	—	+
26	4 days post partum	—	+	—	—	+
27	5 days post partum	—	—	—	—	+
28	Not pregnant	+	+	—	—	+
29	Not pregnant	+	+	—	—	+
30	Not pregnant	—	—	—	—	+
31	Not pregnant	—	—	—	—	+
32	Not pregnant	—	—	—	—	+

<sup>1</sup>(+) indicates positive reaction (+?) a doubtful reaction (—) a negative reaction

These results were again unsatisfactory and not in accord with those obtained by Abderhalden. It was evident that the trouble could not be with the diffusion shells, these behaved properly in the preliminary tests with peptone and serum. Special attention was given therefore to other possibilities of error.

It had been noticed that in some dialysates, which gave unexpected results, a cloudiness was present. Microscopical examination showed that such dialysates — always fluids from which the toluol had completely evaporated — were swarming with bacteria.

This discovery led to greater care in the use of toluol, of which it was found necessary to add at least 1 cc. both within and without the sac in order that some might remain after the 24 hours' incubation. Also greater attention

was given to the cleaning of the glassware, both as regards bacteria and attached protein. It was washed successively in strong acid, alkali, alcohol, ether, and distilled water, and sterilized by dry heat. The distilled water was sterilized, and the diffusion shells before each test were placed in water which was heated to the boiling point. Likewise, the possibility of error in the preparation of the placenta was eliminated. Still the results were not uniform.

This experience, with the control of all other possible errors, led to the conclusion that our trouble was due to the personal equation in the reading of the biuret reaction. Of the correctness of this conclusion we were convinced when, on several occasions, with properly prepared tests and their controls, no agreement in readings could be obtained among four or five persons accustomed to colorimetric readings.

In all these readings it was never a question of a purple or purple-violet ring, but always of the slight changes from a blue to a blue-violet upon which it was seldom possible to have two persons agree. For this reason, as soon as some triketohydrindenhydrat was obtained the biuret reaction was abandoned, and with it disappeared all the difficulties in the interpretation of results.

Triketohydrindenhydrat is put out by a German firm under the commercial name of ninhydrin, and it is by this shorter name that it will hereafter be referred to in this paper. It is a whitish, quickly soluble powder, dispensed in amounts of 0.1 gm. in brown glass vials. Accompanying each package is a circular describing the method of its use. As 0.2 cc. of a 1 per cent watery solution is the amount necessary for a test, the contents of a vial dissolved in 10 cc. of distilled water affords enough reagent for fifty tests. The only description of triketohydrindenhydrat in chemical literature, as far as we can determine, is that of Ruhemann.<sup>1</sup> As it gives a blue color with all compounds that have an amino group in the alpha position, it is of great value in the recognition of the products of the digestion of protein.

The tests were continued, using ninhydrin

<sup>1</sup>J. Chem. Soc., London, 1910, xxvii, 2025.

according to Abderhalden's technique. As ninhydrin is a reagent giving a reaction with the most minute amounts of soluble protein, precautions were redoubled in making the following tests. Although in a few instances the color reactions differed slightly in intensity, no difficulties of interpretation were encountered. The results of the use of this reagent in a second series of cases of pregnancy and of controls using sera of non-pregnant individuals follow:

TABLE II—DIALYSIS METHOD WITH NINHYDRIN  
COLOR REACTION

No	Month of Pregnancy	Serum	Serum plus 1% cent	Pla cent	Aq Dist	Peptone 0.1 per cent
1	Ninth	—	+	—	—	+
2	9 days post partum	—	+	—	—	+
3	Ninth	—	+	—	—	+
4	14 days post partum	—	+	—	—	+
5	1 day post partum	—	+	—	—	+
6	Male	—	—	—	—	+
7	Non pregnant female	—	—	—	—	+
8	Eighth	—	+	—	—	+
9	Eighth	—	+	—	—	+
10	Sixth	—	+	—	—	+
11	Second	—	+	—	—	+
12	6 days post-partum	—	+	—	—	+
13	7 days post partum	—	+	—	—	+
14	3 days post partum	—	+	—	—	+
15	Ninth	—	+	—	—	+
16	Sixth	—	+	—	—	+
17	Fifth	—	+	—	—	+
18	Sixth	—	+	—	—	+
19	Sixth	—	+	—	—	+
20	Seventh	—	+	—	—	+
21	Fifth	—	+	—	—	+
22	Ninth	—	+	—	—	+
23	Eighth	—	+	—	—	+
24	Ninth	—	+	—	—	+
25	Eighth	—	+	—	—	+
26	Eighth	—	+	—	—	+
27	Ninth	+	+	—	—	+
28	Seventh	—	+	—	—	+
29	Ninth	—	+	—	—	+
30	2 days after 2 months abortion	—	+	—	—	+
31	Eighth	—	+	—	—	+
32	Sixth	—	+	—	—	+
33	Seventh	—	+	—	—	+
34	25 days post partum	—	+	—	—	+
35	Eighth	+	+	—	—	+
36	Ninth	—	+	—	—	+
37	Ninth	—	+	—	—	+
38	Ninth, Eclampsic	—	+	—	—	+

1 A very faint reaction 2 Hemoglobin stained serum

It will be seen that, using ninhydrin as the indicator, the results of Abderhalden are in every way duplicated. In a series of 28 pregnant and 8 post-partum women constant positive results were obtained, while in the two controls (one a male) the reaction was negative. The ninhydrin test gave always a frank reaction during pregnancy; in 3 of the 8 post-partum cases the reaction was faint; the control by serum alone was always frankly

negative except in the case of two slightly hæmoglobin stained sera.

The significance of the test in the post-partum period is still doubtful. Abderhalden, as well as Frank and Heiman, reports results which indicate that the reaction is weakened or disappears shortly after the end of pregnancy. This view is supported by our weak reaction in three tests made during the post-partum period. The evidence on this point is, however, insufficient to allow a final conclusion.

With the exception of one pregnancy at the end of the second month, this study does not include a pregnancy earlier than the fifth month. The experience of Abderhalden and of Frank and Heiman, however, indicates that the test is applicable to any period of pregnancy after the second week.

*Control experiments.* Thus far in the investigation it had been impossible, on account of the difficulty of obtaining large amounts of serum, to make control tests of the action of the serum of pregnancy on tissues other than placenta. When, however, the very successful series of results shown in Table II had been obtained the question of control observations was taken up not only in regard to the effect of the serum of pregnancy on tissue other than placenta, but also the effect of the serum of normal individuals and of individuals suffering from various diseases upon placenta and other tissues. Upon these points Abderhalden offers little assistance. His results as printed show controls with non-pregnant women but no controls with sera from individuals suffering from disease. Furthermore, a close examination of his descriptions of the dialysis method fails to reveal (with the exception of two instances in which liver was used) an experiment showing the action of the serum of pregnancy on tissues other than placenta. Our control observations, in view of the brilliant results shown in Table II, have been most disappointing. The serum of pregnancy gives the reaction, as shown in Table III, with a number of tissues other than placenta.

Such results indicate that if the reaction is due to an enzyme, it is a proteolytic enzyme in no way to be considered as specific for pla-

TABLE III—CONTROL OF TISSUES

No	Month of Pregnancy	Serum	Serum plus Placenta	Serum plus Uterus at Term	Serum plus Normal Uterus	Serum plus Carcinomatous Uterus	Serum plus Kidney	Serum plus Kidney (Dog)	Serum plus Heart	Placenta	Uterus at Term	Normal Uterus	Carcinomatous Uterus	Kidney	Kidney (Dog)	Heart
1	Ninth	—	+	+						—	—					
2	Ninth	—	+	+						—	—					
3	Ninth	—	+	+						—	—					
4	Eighth	—	+	+						—	—					
5	Ninth	+	+	+						—	—					
6	Seventh	—	+	+						—	—					
7	Sixth	—	+	+						—	—					
8	Eighth	+	+	+						—	—					
9	Ninth	—	+	+			+		+	—	—			—		—
10	Ninth	—	+	+			+		+	—	—			—		—
11	Fourth	—	—	—	+		+		+	—	—	—		—		—
12	Ninth	—	+	+		+		+	+	—	—	—	—	—	—	—
13	1 day post partum	—	+			+	+	+		—	—		—	—	—	
14	25 days post partum	—	+	+						—	—					

<sup>1</sup> Serum stained by hæmoglobin    <sup>2</sup> Faint reaction    <sup>3</sup> All test tissues are from man except dog's kidney as indicated

centa (chorionic) protein. This, however, would not detract greatly from the value of the method as a clinical procedure if the reaction was obtained only in pregnancy. It may, however, by the method employed, occur when normal sera or the sera of various diseases are used. This is shown in Table IV.

TABLE IV—CONTROLS WITH SERA OF NORMAL AND DISEASED INDIVIDUALS

No	Condition	Serum	Serum plus Placenta (Human)	Serum plus Kidney (Human)	Serum plus Kidney (Dog)	Placenta (Human)	Kidney (Human)	Kidney (Dog)
1	Male (healthy)	—	—	—	—	—	—	—
2	Female non pregnant	—	—	—	—	—	—	—
3	Male (healthy)	—	—	—	—	—	—	—
4	Male (carbuncle)	+	+	+	+	—	—	—
5	Male (healthy)	—	—	—	—	—	—	—
6	Male (healthy)	—	—	—	—	—	—	—
7	Male (healthy)	—	—	—	—	—	—	—
8	Male, nephritic	—	—	—	—	—	—	—
9	Male, nephritic	—	—	—	—	—	—	—
10	Taken, female, age 60	—	—	—	—	—	—	—

<sup>1</sup> Serum hæmoglobin stained

One hesitates, in view of the great importance accorded to all of Abderhalden's work, to offer adverse criticism, and for this reason we have controlled possible sources of error in our own. For example, the reactions due to hæmoglobin or to recent ingestion of food have always been before us as possible sources of error, but these have been eliminated. Only one precaution urged by Abderhalden—the use of the biuret as well as of the ninhydrin test—has not been followed, but our

unsatisfactory results with the biuret reaction has satisfied us of its inaccuracy. Moreover, our controls have been most perfect, and have been carried to the point of testing with the same tissue alone and the same serum alone, the sacs in which unexpected positive reactions with a combination of such tissue and serum have occurred.

That in these control tests we have used chiefly serum from males rather than females does not seem to be a possible source of error.

The results presented in Table IV would seem, therefore, to indicate, provided always that our method is not at fault, that the proteolytic enzyme, if it be such that causes the reaction, may be present in normal individuals, and although increased in pregnancy (as the constantly uniform results presented in Table II would imply), may be increased likewise in conditions of altered metabolism other than pregnancy.

That our experience in obtaining positive results with tissue other than placenta and with serum other than that of pregnancy is not peculiar is shown by the work of Fauser, who, with two exceptions (Frank and Heiman, Franz and Jarisch) offers the only communications on the subject which have not come from Abderhalden or his associates. Fauser studied the sera of individuals with disease of the thyroid, with dementia præcox, syphilis, tabes, paralysis of the insane and other forms of nervous or mental disease. As his problem was in part the relation of

certain psychoses to the internal secretion of the sexual and other glands, he used as tissues to be acted upon by the sera, testicle, thyroid, and brain. The results were very irregular. The serum of Basedow's disease in three cases reacted with both thyroid and brain, the serum of dementia praecox reacted in three cases with both brain and testicle, and in a fourth with thyroid also. In practically all his cases of nervous or mental diseases the serum reacted with brain or cord, but no controls are given. Fauser forms several hypotheses concerning the relation of the glands of internal secretion to psychoses, but the unbiased observer cannot avoid the conclusion that his experiments are inadequately controlled.

If, as we have shown, the serum of pregnancy will react with tissue other than placenta, and the sera of nephritis, tabes, carbuncle, and occasionally normal sera will produce the same reactions with placenta and other tissues, and if, as Fauser's experiments show, reactions may be obtained by the use of the sera of goitre, syphilis and nervous and mental diseases, with thyroid and brain tissue respectively and sometimes with testicle, it is evident that the method cannot yet be utilized as a specific clinical test. In connection with this statement we desire to emphasize the fact that our remarks refer only to the dialysis method with ninhydrin as an indicator. The optical method, which we have not used, may give entirely different and more exact results. It is, however, the dialysis method which can most readily be used as a clinical method.

On one other point we have had difficulty in reaching the same conclusion as Abderhalden. If serum is inactivated by exposure to temperature of 60° C for one half hour he finds the reaction does not appear. This is offered naturally as evidence that the reaction is due to ferment action. We have inactivated five sera of pregnancy but have never been able in this way to entirely prevent the reaction (see Table V). Inactivated serum has, however, always caused a less marked reaction than the control untreated serum, a reaction which when obtained under other circumstances has been called "very faint." When, however, the mixture of

TABLE V—EFFECT OF NORMAL AND HEATED SERUM

Case Number	Month of Pregnancy	Untreated Serum	Untreated serum plus Placenta	Serum Inactivated	Serum Inactivated plus Placenta	Placenta
1	Ninth Month (Healthy)	—	+	—	+	—
2	Ninth Month (Healthy)	—	+	—	+	—
3	Ninth Month (Healthy)	—	+	—	+	—
4	Eighth Month (Healthy)	+	+	—	+	—
5	Eighth Month (Healthy)	+	+	—	+	—

\*Very faint reaction

†Serum 24 hours old

serum and placenta is placed in the refrigerator (0° to 3° C) the reaction does not occur. This indicates that whether or not the ferment is specific the reaction is one dependent on enzyme activity.

Another point of interest is that a serum of pregnancy several days after being drawn does not lose its power to produce the reaction with placenta. One serum was tested at intervals for one week. At the end of seven days the tests with placenta were still positive, and the serum alone gave no reaction. Tests for longer periods have not been made.

Our difficulties with the control tests have led us to try a modification of Abderhalden's method. If the reaction is due to a proteolytic enzyme, the products of this activity, amino-acids, should remain in solution and be unaltered after coagulating a mixture of serum and placenta by heat and acetic acid. The use of the method of dialysis has for its object the separation of products of protein digestion from the unaltered serum proteins. These may be removed just as well by filtering them off from the coagulated serum proteins. The only objection is that amino-acid might be present in the serum used for the test; this danger, however, is present also in the dialysis method. The coagulation method has, moreover, one very important advantage over the dialysis method, if properly performed there is never any question of an unexpected positive reaction being due to the presence of serum which may have escaped through a faulty sac or been introduced accidentally into the dialysate.

We have, therefore, after testing for amino-acids a number of filtrates of normal sera with negative results, abandoned the dialysis sacs and adopted the following technique:

Measured amounts of serum are placed in several tubes, and to one is added boiled placenta, to others boiled kidney, or heart, or whatever the control may be, and with one tube containing serum alone, and others the tissues named above, all are placed in the thermostat at 37° C. for 24 hours. At the end of this time the contents of each tube is poured into a separate beaker, diluted with 20 cc of water, boiled with the addition of acetic acid, and filtered. To 10 cc of each filtrate the ninhydrin test is applied. Although so far we have tried this method with only a few sera, it has given excellent results (see Table VI)

TABLE VI—TESTS WITH BOILED FILTRATE AND NINHYDRIN

Case Number	Month of Pregnancy	Serum	Serum plus Placental	Serum plus Kidney	Serum plus Dog Kidney	Serum plus Uterus	Placenta	Kidney	Dog's Kidney	Uterus
1	Ninth	—	—	—	—	—	—	—	—	—
2	Ninth	—	—	—	—	—	—	—	—	—
3	Ninth	—	—	—	—	—	—	—	—	—
4	Eclampsic	—	—	—	—	—	—	—	—	—
5	Normal male	—	—	—	—	—	—	—	—	—
6	Ninth	—	—	—	—	—	—	—	—	—
7	Eighth	—	—	—	—	—	—	—	—	—
8	Eclampsic	—	—	—	—	—	—	—	—	—

\*All tissues human except dog's kidney as indicated

The positive reactions are always well marked and equal in intensity to those by the dialysis method. Also we have found that if coagulation is complete, so that the filtrate is clear, the difficulties due to hemoglobin-stained sera disappear. Great caution must be observed, however, in the coagulation. Some filtrates have an opalescence, and these should be coagulated a second time. As an extra precaution, we have found it wise in all cases to add a few drops of dilute acetic acid to all filtrates and to boil a second time and watch for clouding before adding the ninhydrin solution. How this modification will stand the test of further work remains to be seen.

#### SUMMARY

The use of Abderhalden's test for pregnancy, employing the dialysis method and the ninhydrin color reaction, has given positive results with each of 28 sera from pregnant women and 8 from women in the post-partum

period, including one after abortion. The test has never been negative in a known pregnancy. On the other hand, the serum of pregnancy reacts with tissues (kidney, heart, uterus) other than placenta, and indeed with other than human tissues (e. g., dog's kidney). Also sera of two cases of nephritis, one of tabes and one of infection (carbuncle), and occasionally of some individuals apparently in perfect health, have given the reaction with placenta and other tissues.

In the use of Abderhalden's dialysis method we have found the ninhydrin reaction far superior to the biuret reaction. It is also important that Schleicher and Schull's smaller dialysis sacks should be used rather than the fish-skin membranes originally recommended.

Results as satisfactory as those by dialysis are obtained by mixing tissue and serum in tubes and, after incubating for 24 hours, testing the filtrate obtained on coagulation by heat and acetic acid with ninhydrin.

Inactivation of the serum causes a great diminution in the degree of reaction but does not cause it to disappear entirely. At zero temperature no reaction occurs. The power of a serum to cause the reaction persists, when the serum is kept under proper conditions of temperature, for at least seven days.

As the result of our studies we feel that this test cannot be accepted as an accurate clinical method until it has been more thoroughly investigated and the possible sources of error corrected. This conclusion, however, applies only to Abderhalden's dialysis method, and not to his optical method, with which we have had no experience.

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## THE EMPLOYMENT OF PROTECTIVE ENZYMES OF THE BLOOD AS A MEANS OF EXTRACORPOREAL DIAGNOSIS

### I.—SERO-DIAGNOSIS OF PREGNANCY

By CAREY PRATT McCORD, M. D., DETROIT

ON the parenteral introduction into the blood of substances in any wise different in structural form from such as normally occur, there arise enzymes capable of disintegrating these foreign materials and transforming them into forms not qualitatively different from normal blood constituents. In short, parenteral digestion takes place. The portal of entry for such materials is from overloading the intestinal tract so that some food passes through the enteric barrier in complex form, from intravenous and intra-abdominal injections, or from the organs of the body that, from their individual specific nature, when thrown in the circulation as unchanged albumins are no less foreign than parenteral injections from without the body.

This formation of protective enzymes then is, sensitization, and all the phenomena of anaphylaxis and immunity are closely allied. In this phenomenon is the basis for all prophylactic vaccination and the foundation for the curative activity of such substances as tuberculin. Although physiological in its nature, this disintegrating of stable proteins is not without its deleterious action as evidenced in the autointoxications

Such an enzyme cleavage of proteins underlies the various cutaneous reactions, such as lepro-diagnosis, tuberculin reaction and the cutaneous diagnosis of syphilis. These phenomena come as a result of introduction and cleavage of substances of a kind like unto that with which the organism is sensitized. Not only will this cleavage take place within the body, as in the instances cited but the drawn blood contains the active enzymes, and when placed in contact with substances against which they were generated, structural disrupting occurs extracorporeally, with a breaking down into simple forms similar to that occurring intracorporeally.

This held opens up unlimited possibilities for usefulness in diagnosis. The excellent work of Abderhalden (1) has developed many interesting facts which are likely to prove useful to both the clinician and the technical worker. Abderhalden's personal attention has been given largely to the sero-diagnosis of pregnancy, which is based wholly on the principles appearing above. His methods are, however, applicable to many phases of the same field. These methods, with modifications of our own, have been successfully employed in the present experimental labora-

tory study of the sero-diagnosis of pregnancy and the sero-diagnosis of toxic goitre. This paper deals only with the sero-diagnosis of pregnancy, and will be followed by a second paper on the diagnosis of toxic goitre

#### THE SERO-DIAGNOSIS OF PREGNANCY

The utility of such a method of diagnosis of pregnancy, if found trustworthy, is too obvious to need comment. It has long been known that the placenta, in its developing stage and period of growth in particular, discharges into the maternal circulation microscopic portions of the chorionic villi. The nausea, vomiting and other signs of intoxication are probably concomitant to the entrance of these extraneous placental portions. On their appearance in the circulation, enzymes relatively specific against chorionic villi are mobilized by the body, to which the name "choriolysins" has been given. It is around this phenomenon that the work centers.

#### EXPERIMENTAL METHODS

*Preparation of placenta* The placenta of humans, cows, dogs and guinea pigs were used. The placenta were obtained at earlier stages than complete gestation, save in the case of women. These were obtained from normal patients in normal labor. The placenta were freed from blood completely. Flushing through the umbilical vessels removes much of the blood at once. The foetal membranes and cord were removed and discarded. The removal of the remaining blood content was facilitated by cutting into small portions and placing in a sieve under a running tap. On complete freeing from blood, the placenta were placed in boiling water in a porcelain dish and boiled. Contrary to the experience of Abderhalden, we found that boiling for two five-minute periods was rarely sufficient. After boiling for five minutes the water was drained away and the tissue rinsed thoroughly and reboiled for a period of ten minutes. A 5 cc sample of the boiling fluid was tested, in the manner described by Abderhalden and later in this paper, for non-coagulated protein. If positive, the process of changing water and boiling was repeated until the test was negative. Twenty to thirty minutes of actual

boiling was necessary on the average. The placenta and fluid were poured into a large-mouth bottle and covered with toluol and tightly covered. This preparation was kept in the cold room to prevent deterioration.

*Desiccated placental preparation.* We found a more permanent and more easily handled preparation of placenta was to be obtained in the following way. The placenta were boiled (after being washed free of blood) in the manner described above until the fluid on boiling with the reagent was negative. Toluol was added. The placental pieces were then rapidly ground to a fine paste in a Latapie grinder, and repeatedly extracted with pure acetone until the acetone remained uncolored from the placenta. The acetone was separated from the placenta by filtration through a Buchner funnel with exhaust. The placenta was dried in vacuo in an atmosphere of toluol vapor at room temperature. On complete drying, the placenta (at all times protected from contamination) was ground to a fine powder. The finished product is a fine, nearly white powder. This was used in the same way as the coagulated placenta, and by comparison with it in the same cases was found equally trustworthy.

*Obtaining of blood serum* The serum must be obtained from the patient within a few hours prior to making the test. At least 3 cc of clear serum is necessary, so that from 6 to 10 cc of blood must be drawn. The serum must be free from hæmoglobin. The hæmoglobin itself is probably non-consequential, but its presence indicates the disrupting of blood cells, with the liberation of enzymes capable of vitiating the true condition. To obtain perfectly clear serum offers considerable difficulty. In animal work it was comparatively easy to obtain such a serum by drawing blood directly into small centrifuge tubes and quickly throwing down the cell content before coagulation occurred. Of this the upper half is usually a clear, hæmoglobin-free coagulum. By placing a glass bead on this and recentrifuging, a clear serum is expressed. In actual clinical work, clear serum usually may be obtained by drawing the blood from a vein of the forearm of the patient with a syringe, as for a Wassermann

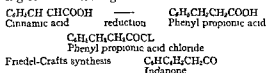
test. The blood is transferred immediately to small 5 cc. tubes and centrifugalized as described above, if suitable centrifuge is available. If no centrifuge sufficiently powerful to throw down blood corpuscles is at hand, the serum may be obtained by transferring the blood from the syringe to 5 cc paraffined tubes packed in snow or ice. The blood thus kept cold is delayed in its coagulation so that the corpuscles tend to settle to the bottom. When coagulation does occur, the upper half again is relatively free from hæmoglobin, so that on standing a serum is spontaneously expressed that is usually free from hæmoglobin.

**Dialyzing apparatus** The most prolific source of error arises from the dialyzing membranes. Abderhalden employed fish bladder kondoms in his original work, and later used and recommended the parchment thimbles of Schleicher and Schull. In our work collodion thimbles of about 20 mm diameter were employed in a satisfactory way, except that it is difficult to obtain these collodion sacs of equal thickness so as not to interfere with the rate of dialysis. The parchment tubes were open to the same objection. Each tube had to be tested for weak spots and pin holes. Some tubes were entirely too thick, while others were too thin. These parchment tubes, after elimination of such sources of error, were by far the most serviceable and dependable of the forms of dialyzing apparatus investigated. These, with proper cleaning, may be used repeatedly.

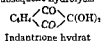
**The triketohydrindenhydrat reaction.** This reagent was the chemical test for the dialyzable products. The material used was in part the market substance of Meister Lucius and Bruning, and in part supplied by Dr V. L. King of this laboratory, who in addition has supplied the data for the description of the chemical nature of the substance.

To detect the digestion products of proteins (placenta) in Abderhalden's biochemical test for pregnancy, a reaction was required which was extremely sensitive. In the digestive process albumin is degraded gradually, so that under the conditions of the test, only the dialyzable products being separated, peptones and amino-acids are the substances

to be detected. The biuret reaction, which was discovered by Rose (2), is a method of detection of soluble substances possessing  $\text{NH}(\text{CONH}_2)_2$ ,  $(\text{CONH}_2)_2$ ,  $\text{CH}_2(\text{CONH}_2)_2$ , acid amide groups, when two  $-\text{CONH}_2$  groups are connected by a N atom, a C atom, or directly to one another. The peptones contain two such groups and give the biuret reaction very strongly. As the digestion proceeds *in vitro*, however, the peptones are converted still further to the amino-acids and hence the solution to be tested will contain largely  $\alpha$ -amino-acids rather than peptones. The ideal reagent, therefore, is one which is specific for  $\alpha$ -amino acids. From among the numerous substances available, Abderhalden found indantrione hydrat (triketohydrindenhydrat) to give the most reliable results. The amino acids resulting from the digestion of albumin are always  $\alpha$ -amino-acids. No other kinds have ever been found. Indantrione hydrat reacts only with the  $\alpha$ -acids, although it also reacts with peptones and all substances containing acid amide groups to form soluble violet dyes. The solutions are dichroitic and appear red in transmitted light. The indantrione has become available through the researches of Ruhemann (3) and Perkin (4). It is prepared from cinnamic acid according to the following reactions



Condensation with p-nitroso dimethyl anilin to a substituted anil and subsequent hydrolysis



**The test.** One half gram of the coagulated placenta or  $\frac{1}{4}$  gram of desiccated placenta is placed in the parchment thimble. This thimble should be washed thoroughly just prior to use. Add to the placenta in the tube  $1\frac{1}{2}$  cc. of serum free from hæmoglobin. Avoid any contact of placenta and serum with outside of thimble. As a further precaution rinse thoroughly on the outside. Place in dialyzing jar containing 10 to 20 cc distilled water. A large test tube makes a

suitable dialyzing jar. Add a layer of toluol to the surface of the water and to the thimble contents to prevent deterioration. In like manner prepare a control test in all respects similar except no placenta is added to the serum. This control is essential and no test is dependable without it. These tubes are tightly covered and kept at body temperature (incubator) for a period of 12 to 16 hours. At the end of that time the dialysates are tested with triketohydrindenhydrat. Take 10 cc. of the dialysate and place in a test tube. To it add .2 cc. of a 1 per cent solution of triketohydrindenhydrat. Boil continuously for one minute. If positive, an intense violet color appears during the boiling and remains. The amount of color is a relatively quantitative indication of the degree of positivity. Boil control in same way. Compare color of control and test. No case is to be considered positive unless the test is more positive than control. The color deepens on standing, so that the sharpest difference in degree of color appears after standing for about 15 minutes.

#### INTERPRETATION OF RESULTS

The value of the test lies not so much in the positivity of the test as in the relative negativity of the control. Contrary to Abderhalden, in animal work our controls were nearly always faintly positive, even when all mechanical sources of error were removed. This fact is very reasonable, for the blood contains amino groups in easily detectable amounts from digestive processes. Serum drawn at the height of food absorption contains more amino groups that are readily dialyzable, but even on starvation some serums give positive reactions after dialyzation. Further, in the case of pregnancy blood may be drawn just at the time of intracorporeal digestion of chorionic villi from the patient's own placenta. In this case the digestion would continue extracorporeally, and give rise to a positive test. Quite obviously the two thimbles used in dialyzing must be of relatively equal thickness, for a thin control tube would be readily penetrated by the small amount of contained amino groups, while in the presence of pregnancy even, the test, if made in a much thicker

thimble, would with difficulty be penetrated and would give rise to questionable results. A test, to be positive, must, after removal of mechanical sources of error, give a more pronounced coloration than the control. The control may be negative, then any violet coloration in the test is an indication of pregnancy. Equal coloration of control and test is a negative indication. In our hands tests were made in the above manner, using as control not only the serum without placenta but placenta in distilled water and in using the desiccated placenta, the coagulated placenta of Abderhalden was used as a further control. Results are based only on laboratory experiments. These yielded about 95 per cent of accurate tests. These we were able to follow up by autopsy and exhibition of the fetuses or the demonstration of non-pregnancy. Errors of technique account in the main for the remaining 5 per cent. However, in the presence of unquestionable pregnancy, negative tests have occurred in two experiments. The paucity of data from clinical work does not allow any records being included in the present paper. What we have, however, would suggest that the test is more accurate for human subjects than for animals, in that the controls are many times negative or only faintly positive in women, while in laboratory animals the blood serum normally dialyzes to the extent of giving positive findings in the controls. The decision between positive and negative tests is never doubtful in the human.

These observations are based on 240 tests under varied conditions and at different stages of pregnancy. Our findings lead us to conclude that the sero-diagnosis of pregnancy is both reliable and practical. The method has its limitations, and the technique requires great care. In the hands of the careful worker the method is of sufficient merit to prove of great value to the obstetrician and gynecologist.

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# DEPARTMENT OF TECHNIQUE

## REPORT OF THE RADICAL OPERATIVE CURE OF A DOUBLE OBTURATOR HERNIA<sup>1</sup>

By C. VAN ZWALENBURG, M. D., RIVERSIDE, CALIFORNIA

W. B. COLEY, in "Keen's Surgery," says, "Obturator hernia is extremely rare, only 200 cases having been reported [This was in 1907 and since then several have been added.] The diagnosis has rarely been made until strangulation had occurred, and even then the true condition has not been made out until after operation had been performed, on the supposition that the patient was suffering from intestinal obstruction of unknown origin. At the Hospital for Ruptured and Crippled, in New York, in upwards of 75,000 cases observed since 1890, not a single case has been noted. It occurs usually in emaciated old people in the proportion of 144 women to 23 men. Of 21 cases collected from the literature, treated by laparotomy, 9 were successful, or 42.85 per cent. In 105 cases of obturator hernia collected by Schwarzschild, no operation was performed in 62 cases, of 43 cases operated upon, 17 were cured. The method of operation in the cured cases was femoral incision in 13, laparotomy in 3, a combination of both methods in one. An artificial anus was established in 4, with 4 deaths, intestinal resection was done in 5 cases, with 1 recovery."

The obturator foramen is ordinarily no larger than sufficient for the passage of the obturator nerve and blood-vessels. It is found doubly protected by the obturator internus and externus and pectineus muscles. When the foramen becomes enlarged for any reason, usually loss of fat, these muscles still protect, to a large extent, as the muscle fibers originate from all the margins of the opening. When a hernial sac pushes itself out into these muscles its progress is very quickly arrested by the strength and activity of the muscles, so that an obturator hernia is always small, forming a little cone-shaped pocket in these muscles, containing very little intestine. In fact, a goodly share of the strangulations recorded are of the so-called Richter type, that is, strangulating only a portion of the lumen of the gut. This small size of the hernia makes it al-

most impossible to palpate, in fact there are very few cases in which a tumor can be made out. The only important symptom laid down as pointing to an obturator hernia is the so-called Howship-Romberg symptom, which consists in pain and sensory disturbance along the inside of the thigh, due to pressure upon the obturator nerve. This symptom, however, is present only exceptionally, and may be produced by various other conditions, and it is only of confirmatory value. Since all of the cases recorded were strangulated at the time of observance, the treatment has consisted usually of simply relieving the strangulation. This has been done generally by abdominal section, as the indications were for an operation and for the relief of intestinal obstruction of obscure origin. A few, however, have opened down upon the obturator hernia externally, and relieved the strangulation by incising the ring of the sac. Some have used the combined method, opening the abdomen and also cutting down upon the obturator foramen in the thigh. Some attempts at radical cure have been made, first, by covering the opening externally by muscle fibers taken from the obturator and pectineus muscles, second, by closing the opening with fascia from the neighborhood, and lastly, by an osteoplastic flap, originally proposed by Trendelenburg and Kraske in 1861 for large femoral hernia. Schwarzschild operated for radical cure upon an obturator hernia, strangulated for the third time. He chiseled a periosteal flap from the inner side of the symphysis pubis and the descending ramus and placed it directly over the hernial opening, holding it there with catgut sutures.

I have been unable to find the record of a single case of radical cure undertaken in the absence of strangulation.

My patient, Mrs. A., aged 76, was first seen December 24, 1910. She was markedly emaciated, weighing 110 pounds, though her height was five feet six inches, and formerly she had weighed 150 pounds. History: Mother of

<sup>1</sup>Read before the Southern California Medical Society, Los Angeles, December 5, 1913.

four children. Has usually been well, but never robust. Twenty-six years ago she began to have attacks of abdominal pain, colicky in character, coming suddenly and continuing from a few minutes up to two or three hours, rarely they are accompanied by nausea and vomiting. They occur all the way from once in six months to twice a week. Until about four years ago the pain was referred to the right side of the abdomen, low down and sometimes radiating to the right thigh. Since that time the pain has been more frequently referred to the left side, however, it may occur on either side, but she is usually right in predicting that when it occurs on the right side, it is less severe and of shorter duration. During the last six months she has had frequent slight attacks, interspersed by severe attacks (lasting upwards of half an hour) as often as once a week. During these twenty-six years she has been variously treated for stomach trouble and various other forms of digestive disturbances, she has been dieted until she is very cautious about what she eats, and has reduced her diet to a minimum, no doubt increasing her emaciation.

The sudden onset and the colicky nature of the pain pointed to some form of strangulation, due to the twisting of some abdominal organ or to hernia. My first search was in the pelvis. Bimanual examination revealed no cause for the pain. At my second visit, on the occasion of a severe attack, the patient spoke of the pain radiating along the inside of the thigh as far down as the knee. At one time, the first intimation she had of colic was an excruciating pain in her foot, extending up the limb. Another suggestive symptom was the fact that three or four years ago she had discovered that the knee-chest position, or anything approaching an inverted position of the abdomen, was likely to ease up the pain. Further investigating the obturator region, I found that when an attack of colic was on there was tenderness over the obturator foramen. Releasing the adductor muscles by carrying the limb over to the opposite side, by careful palpation I imagined there was a little fullness in this region, such as a protruding hernia would produce, but I was impressed by the difficulty of locating a protruding small mass under these muscles, even in a patient as emaciated as Mrs. A. I was able on two or three occasions by pressure and manipulation over the foramen, to relieve the pain, and after the relief of the colic no tenderness could be elicited in this region. The diagnosis of left obturator hernia seemed complete.

Summing up: 1. The sudden, unheralded onset of the pain. 2. The colicky nature of the pain. 3. The radiation along the obturator nerve. 4. The tenderness over the obturator region. 5. The relief from pain by posture. 6. The relief from pain after taxis. 7. The absence of tenderness after the attack had passed. Owing to the increasing frequency and the severe character of the pain and the danger of strangulation, operation for radical cure was advised and finally consented to, it was performed on March 14, 1911. The patient was etherized, and incision made through the left rectus. The Trendelenburg position gave a beautiful exposure of the obturator regions. The left obturator opening was plainly enlarged, easily receiving the index finger, a pair of artery clamps was inserted into the opening, and the interior of the sac grasped and inverted into the abdomen. It was about two inches long.

A chromicized catgut suture was now passed in and out along the inverted sac and the whole thoroughly quilted down upon the obturator foramen, imitating a method I had seen C. H. Mayo use in a femoral hernia from the inside of the abdomen when it was opened for some other diseased condition. It is a modification of the Kocher inversion of the sac in inguinal hernia, there is no quilting

the sac back and forth through the muscles as is done by the Kocher method. The assurance given us by Dr. Mayo that it was a perfectly reliable method gave me confidence to try it here, as the mechanics seem to me practically identical in the two forms of hernia—the sharp edges and the small sac. The right obturator foramen was large enough to easily receive the little finger. This sac was also inverted and closed in the same manner that the left had been. A mass of fat was found adhering to the sac, and this in part accounted for the fact that an attack of colic radiating to the right side would not seem as severe as one referred to the left side, evidently less intestine was forced into this opening. The abdomen was closed, and the patient made an uninterrupted recovery. She walked out of the hospital March 27th, thirteen days after the operation, and has been perfectly free from colic or any other disturbance since that time, now twenty months.

It seems quite remarkable that this patient should suffer all these twenty-six years from these repeated attacks of colic, which were undoubtedly due to a semi-strangulation, without ever going on to a complete strangulation. History of repeated colic in these cases is quite common. In seeking for the cause, we find a firm, sharp edge of the obturator membrane making up considerable of the circumference of the opening through which the hernia protrudes. The lack of pliability, together with the sharpness of the edge, must increase the likelihood to colic and to strangulation as compared to hernia in other localities. In this case, this long period of colic without complete strangulation gave an excellent opportunity for study of the case and greatly facilitated the making of a diagnosis. The prominence of the Howship-Romberg symptom also aided materially, although it was hard to elicit this history, in fact, some of its more striking features were never disclosed until after the operation and recovery, especially the one referring to pain in the foot. This was an exaggeration of the ordinary pressure symptoms on the obturator nerve, which might be confusing but is explained in the light of the entire history and the finding at operation.

Next to the diagnosis, the treatment is the other interesting consideration in this hernia. That the abdominal route to operative treatment is the preferable one seemed to me quite evident, and is, I think, now generally accepted. Aside from the indication to open the abdomen for strangulation, it is better to close the inner end of the "tube" into which the hernia passes than the outer end; to say nothing of the difficulties of working under the muscles which cover this region. The rigidity of the edges of the obturator opening makes it difficult to permanently repair it. It is impossible to suture it directly. A radical cure is reported by Korner and Huggins,<sup>1</sup>

<sup>1</sup>The Lancet, January 23, 1909.

which was done at a third strangulation. In that case, the strangulation was first relieved by abdominal section; an incision was then made in the thigh with the expectation of closing the opening from this point. However, the tube-like character of the opening prevented prospects of a satisfactory result; closing the outer end would not prevent entrance into the inner end. The sac was then inverted and stitched down from the inside of the abdomen and the relaxed obturator fascia also closed. Discussing their paper before the Surgical Section of the Royal Society of Medicine, Barker asked if the sac could not have been inverted without the incision in the thigh. He had himself repaired a femoral hernia in that manner, and suggested that it might be used in obturator hernia as well. Korner replied that an attempt had been made to do so but had failed, and the thigh incision had been considered necessary. Though this suggestion was made by Barker two years before my operation, I was not aware of it at the time.

From this one experience I am not prepared to state that my method of closing would be absolutely the best in all cases. It looks as though we were depending upon rather unstable tissues. However, in a patient aged 76, who would give it little strain in the years still allotted to her, it would seem sufficient and the simplicity of the

technique reduced the time of operation to a minimum. I am sorry I have no evidence or statistics to offer on the final results of this form of closure of a femoral hernia. However, when we consider that the obturator, as well as the femoral opening, is originally largely closed by loose fatty and fibrous tissues, and that one of the causes of obturator hernia is understood to be the wasting of this fatty tissue, I feel a great deal of security in the plug which I made by quilting down the inverted sac upon the opening.

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## PROSTATECTOMY BY A COMPOSITE METHOD<sup>1</sup>

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BY the term "composite" is meant a method that utilizes features of technique devised by various operators. These have been blended to form what the author at this time considers the best procedure in the facility of operation with minimum danger, speedy recovery, and excellence of final results.

The steps of this composite operation are as follows: suprapubic incision (Belfield, 1883, McGill, 1886), total enucleation by the index finger (Eugene Fuller, 1894), support of the prostate by fingers in the rectum (Guiteras, 1898), scoring the apex of the prostate with the finger nail to start enucleation (Freyer, 1900), and intra-urethral puncture with the finger to better conserve the internal sphincter.<sup>2</sup> To this I have added delivery of the large gland through the

small incision by traction with forceps,<sup>3</sup> and finally, in completing the operation and conducting the after treatment, two features which, though I have satisfactorily used for several years, are now in print for the first time. They are valvular suspension of the bladder by two sutures, and the total abandonment of irrigation, either at the time of operation or during the after treatment.

This paper is based on a personal experience of over 300 prostatectomies and on the observations made in a recent pilgrimage to the principal prostatectomists of America and Europe. Individually and collectively, the profession is striving for the best results, and surgical procedures are being constantly molded to that end. In this effort for improvement the changes made

<sup>1</sup> J. Bentley Squier, *Surg., Gynec. & Obst.* Nov., 1913.

<sup>2</sup> St. Louis Courier of Med. 1908.

<sup>3</sup> Read before the North Pacific Surgical Association, Vancouver, B. C. December 14, 1913.

in original methods are sometimes advantageous, but occasionally quite the reverse. To prove all things and hold fast to that which is good requires opportunity, experience, and judgment. The final adoption of this method is the result of the trial and abandonment of many features of operative technique and post-operative treatment.

Consideration will here be given only to the treatment of ordinary prostatic hypertrophy. It should be well borne in mind that the inflammatory, adherent, atrophic prostate and malignant disease of the prostate produce similar obstructive symptoms. The effect of stricture of the urethra, tubes and other cord lesions in producing urinary retention must not be overlooked. The diagnosis, if possible, should be thoroughly established before the operation is undertaken, keeping in mind the important fact that every case of urinary obstruction in men past middle age may not be caused by prostatic hypertrophy.

Before proceeding with a detailed description of the composite technique, there are two points that we may well discuss. They are the choice of route and the anæsthetic.

Twelve years ago a strong sentiment in favor of the perineal over the suprapubic method in prostatectomy became prevalent. It was quite usual, from that time and subsequently, to find in the first paragraphs of papers on prostatectomy the statement that the suprapubic route was attended by a higher mortality than the perineal. It was advocated that the perineal operation was done under unobstructed view, which is quite true of a part of Young's operation as he does it, but is by no means true of the majority of those who attempt to follow his method, and is not at all true of other perineal operations. I have witnessed some woeful digging in bloody fields during the performance of perineal prostatectomy. The claim for a smaller mortality in perineal operations is a fallacy, which has been repeated from one to the other until it is accepted as a truth. The claim for better conservation of sexual function or urinary control has not been proved in practice. It is now very generally conceded that in these particulars also the suprapubic operation gives better results. The pendulum of choice has now swung the other way, and I think it safe to say that at the present time, the world over, nine tenths of the operations for removal of the prostate are done by the suprapubic route.

A word on the important question of mortality. By the composite operation in ordinary prostatic

hypertrophy, if the patient is even in fair condition, there should be no mortality. If the patient is uræmic from renal insufficiency caused by long continued back pressure from an over-distended bladder, vesical drainage either by the retained catheter or by suprapubic incision should be instituted until the patient shows signs of reviving. Suprapubic incision in such a case, if the bladder is over-distended, can be made without anesthesia by an instantaneous stab wound through all the tissues directly into the bladder. This should be done only when the distended bladder can be palpated as a tumor extending to near the umbilicus. In the cases that require it the stab wound is as painless as the puncture of the aspirator needle. These patients are usually in a semicomatose condition. Drainage is made by a vertical stab about 1 or  $1\frac{1}{2}$  inches above the pubic bone, the edge of the blade being downward, and a cut about an inch long being made toward the pubes as the knife emerges. If the patient rallies, suprapubic prostatectomy may be done a few days later through a slight extension of this incision.

Prostatectomy by the composite method, if properly done, should be a short operation. The gland can usually be delivered in from 4 to 10 minutes, and the introduction of the suspension sutures and the finishing stitches will occupy but a few minutes more. In this matter, however, experience and deftness have much to do with the time required and the smoothness of the operation. Recently I operated on a man 70 years of age, whose left hip was ankylosed in a position of slight adduction. This would make the usual rectal elevation with the left hand a little less convenient, so I decided to do the enucleation with my left hand, using the right to support the gland. The prostate was of medium size, soft, and easily enucleated, but it required 7 minutes to deliver a gland that ordinarily would have been delivered in 4 minutes. Notwithstanding my general experience in prostatectomy, it was the only one I had ever done with the left hand. It illustrated well to me the advantage of the special training that experience gives in this manipulation.

Ordinarily, either is the anæsthetic of choice. A preliminary hypodermic of  $\frac{1}{8}$  of a grain of morphin and  $\frac{1}{16}$  of atropin, or  $\frac{1}{16}$  of scopolamin or hyoscin may be given. This not only has the advantage of quieting preoperative anxiety and diminishing the amount of ether necessary, but tends to allay post-operative pain. Recently I have employed spinal anesthesia with stovain almost exclusively. It should be



remembered, however, that the use of this or any other nerve-root anæsthetic in the spinal canal requires special training and great care, and that at the present time the mortality from its use in all conditions exceeds the mortality of ether. To offset this, however, we have the fact that in aged men the kidneys and heart are frequently at fault, and in them are found contraindications for the use of ether. In this class of subjects, when properly administered, I believe that spinal anæsthesia is an exceedingly valuable agent. I have not seen nausea or depression in a single instance in which I have made use of it in prostatectomy. The anæsthesia is complete, and with the distinct advantages that the abdominal muscles are thoroughly relaxed and that the anæsthesia continues for an hour or two after the patient is returned to bed, thus obviating post-operative pain. The very slight disturbance of the anæsthetic and operation is well illustrated by the case of one man who smoked a cigar while the operation was being performed and called for his luncheon as soon as he was returned to his room saying that he was hungry, as he had not been served with breakfast. If a shock block is desirable in this operation, and it must be admitted that there is some evidence to support this contention, then we have in lumbar anæsthesia an efficient block.

To any who wish to study this procedure I earnestly recommend the perusal of the comprehensive article on "The Anatomy and Technique of Spinal Puncture," by Wm C Lusk,<sup>1</sup> and the paper by Babcock in *SURGERY, GYNECOLOGY AND OBSTETRICS* for November, 1912, also those of Allen and of Bainbridge.<sup>2</sup> After this, a little preliminary experience gained by using it in operations on the lower extremities will prepare the surgeon for its use in prostatectomy. An important point in using a heavier than spinal fluid medium is to keep the head and shoulders elevated on several pillows so that the stovain will not reach the respiratory centers. If the anæsthetic line does not reach the abdomen within ten minutes the patient may lie flat for a few minutes, careful watch being kept of the advancing anæsthesia, and head and shoulders being again raised when it has reached the proper point. The same elevation is to be maintained on the stretcher when the patient is being returned to his room and for several hours after he has been placed in bed. The stovain solution should be made heavier than spinal fluid by the addition of sodium chloride. With this position, a well-

placed puncture, and proper dosage, lumbar anæsthesia with stovain is ideal for prostatectomy.

In favor of a short incision, it must be evident to any close observer that the critical part of the enucleation at the base of the gland is always out of the field of view, even when the top of the gland is uncovered by a long incision held apart by retractors. The surgeon who does not have confidence in his sense of touch gets but little aid from the bloody view at the bottom of the long retractors under a partly detached prostate. One of the supposed advantages of the wide-open bladder is that the bleeding may be controlled by packing. Less than a year ago I saw one surgeon in New York do three consecutive suprapubic prostatectomies in a morning clinic. In all three he made a long incision and exposed the bottom of the bladder by two or three long retractors. There was much sponging, and at the conclusion, besides a large drainage tube, he packed the bladder with numerous strips of gauze. I have never had occasion to pack the bladder in a single instance. In my experience, the only glands that have given any troublesome bleeding have been the inflammatory, adherent type, representing only a small percentage of the total number. Since the use of irrigation has been discontinued even these cases have given no trouble. In the ordinary cases bleeding ceases spontaneously in a short time.

The total abandonment of irrigation at the time of operation or during the after treatment has been followed by a distinct improvement of the convalescent period. The caustic effect of ammoniacal urine on the freshly cut surfaces is no longer observed and bladder sloughs are not seen. The adherent blood clot is the best protection the tissues can have against this source of irritation and its associated infections. Under the blood clot the tissues are soon safely protected by infiltration with phagocytic leucocytes, and the healing process is at once established. The bladder at once fills with clots, but these act only as hæmostatics, as nature intended they should. The drainage tube is also blocked by them. The urine, however, keeps an open track for itself through the space around the outside of the tube. Presently the clots are dissolved by the urine, which becomes clear, the drainage tube opens, and the bladder closes around its sides. Irrigation after the operation, either occasional or continuous, as formerly practiced, can do nothing but harm.

On the tenth day post-operative, when the drainage tube is removed, I have in a number of cases irrigated the bladder through a catheter in

<sup>1</sup>Ann Surg, Phila Oct, 1911

<sup>2</sup>J Am M Ass Nov 23 1912

the urethra, and then, while the clear water was flowing, have inspected the base of the bladder through a large, direct-vision cystoscope to observe the healing process. By this time the cavity from which the prostate was removed has become small and funnel-shaped, with the urethra at the bottom and the sides lined by granulations. The upper rim is the mucous membrane of the bladder. The epithelium soon covers the granulation tissue, the lines advancing from the urethral orifice below, and the bladder wall above meeting on the sides of the small funnel.<sup>1</sup>

The detail of the composite method is as follows. Preliminary preparation by a dose of castor oil given thirty hours before time of operation, and by drinking much water up to four hours before operation, either or lumbar anesthesia; place patient flat on well-padded table, with chest and legs covered to keep him warm. While the anæsthetic is taking effect shave the pubes and clean the surface. Do not prepare these patients the night before and give them the worry of the process and the discomfort of wet dressings. The Trendelenburg position is not necessary. With a soft catheter, when this can be introduced, draw the urine and fill the bladder with warm water. Where catheterization with any catheter is very difficult, and the bladder is well distended with urine, the operation may be proceeded with without any bladder irrigation. There should be one assistant, who may wear gloves. The operator stands at the left of the patient, and wears a glove on his left hand, but keeps the right hand bare. The index finger of the left hand is pressed firmly against the top border of the pubic bone at the middle line. The incision is to begin at the upper border of the finger and extend upward for a distance of  $\frac{1}{2}$  or, if the gland is large or the patient very fat, 2 inches. At one stroke the knife should penetrate through the fascia. The fibers of the muscles are separated with the finger or handle of the scalpel, and the fat on the bladder surface pushed upward with the tip of the left index finger. The scalpel is introduced onto the bladder wall, and drawn with the back upward to the upper end of the intermuscular incision. This is in the space of Retzius, and ordinarily at least an inch, and sometimes more, below the peritoneal fold. The distention of the bladder with water and the upward stroke of the finger followed by the scalpel point are necessary to

absolutely insure this. With these precautions the knife may be plunged boldly into the bladder, tipping then the point downward under the pubic bone, and finishing the incision by a single upward cut as it emerges. While the water is rushing out of the bladder, and before it has had time to collapse, the bare index finger of the right hand is thrust into the bladder. It sounds the bladder for stone, and determines the size, contour, and density of the prostate. The glove on the left hand is then lubricated and two fingers introduced into the rectum, raising the gland up to facilitate its enucleation. The method of Freyer, as modified by Squier, is then used in puncturing the base of the bladder over the apex of the gland just inside of the urethra.

Squier calls attention to the fact that the oncoming hypertrophy pushes the internal sphincter upward into the bladder and then dilates it, pressing the middle or prolongations of the lateral lobes through this. He recommends that the finger puncture be made inside of the urethra, claiming that in this situation the internal sphincter is less likely to be injured. If his contention that the internal sphincter is dilated by the hypertrophy and that the gland rises above it is true, then the scissors cut of Fuller and the puncture on the crown of the prostate as made by Freyer also come inside of the sphincter. This much is true that incontinence after either of these methods is very rare indeed. Only two weeks have intervened between the arrival of Squier's paper and this writing. In that time I have done four prostatectomies, and have used his method of boring into the prostate just inside of the urethra.

In proceeding with the operation, the prostate is steadied by the fingers in the rectum, and the tip of the right index finger is bored through the urethral wall on the crown of the prostate, preferably a little to one side of the midline. When the puncture is made in this way, the sense of touch readily determines the line of cleavage and is a guide to the operator in enucleation of the gland. The finger is kept in the cleavage line and proceeds posteriorly, first to the left and then to the right, separating the internal orifice of the urethra around the crown of the prostate, then anteriorly, and lastly at the base, raising the gland and allowing the separated prostatic urethra to slip out of the gland. The urethra tears at its weakest point, which is above the openings of the ejaculatory ducts, thus leaving them and the vesical sphincter uninjured. In the very large myomatous prostate the lateral lobes may be separated with the finger and the

<sup>1</sup> If the urine precipitates phosphates in the bladder or on the edges of the wound or on the sutures it may be made acid by the administration of 2 to 4 cc. of dilute phosphoric acid, or a few drops of sulphuric acid to be taken in a full glass of water three times a day.

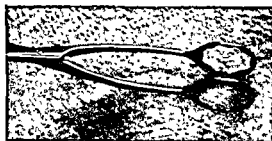
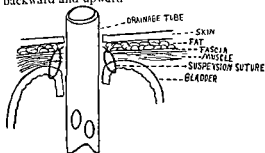


Fig 1 Rockey's prostatectomy forceps

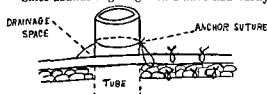
gland delivered in two pieces. I have sometimes separated it only in front to facilitate drawing the large gland through a small incision. The prostate now lies free in the bladder. The glove is then drawn from the left hand, and, under the guidance of the left index finger, the delivery of the loosened prostate is accomplished by a pair of suitable fenestrated forceps. Formerly I used an ordinary sponge or tongue forceps. Recently, however, I have devised a special forceps for this purpose (Fig 1). It has an oval blade with smooth edges, and a scalloped fenestrum which will hold the prostate without tearing any chance bit of the vesical mucosa which might be caught in its grip. By care and a little manipulation a large gland may be quickly delivered through a small incision. The gland is soft and elongates as it is seized with the forceps, and the bladder wall is elastic. The enucleation of a large gland requires no longer bladder incision than a small one. The room required for the delivery of the elongated gland from the bladder marks the limit of the required incision. In practice, I find that in thin subjects a  $1\frac{1}{2}$  inch skin incision and in ordinarily fat subjects a 2-inch incision is about right. In fat men, a distinct advantage in enucleation may be gained by having the assistant place both hands flat just above the incision, and press the belly wall backward and upward.



CROSS SECTION  
Fig 2

After the delivery of the gland, the valvular suspension suture (Fig. 2) is introduced. I regard this as a most important step in expediting recovery. The edge of the wound on one side is held back by a small retractor. A Robeson needle threaded with No. 3 catgut is passed through the fascia and muscle. The left index finger is introduced into the collapsed bladder and hooks it up and brings it into the opening. The edge of the bladder incision is seized with a toothed haemostat and drawn out until the needle can be readily inserted half or three quarters of an inch from the margin of the incision. The needle then dips in and out of the bladder wall, and then up through the muscle and fascia. A similar suture is inserted on the other side. When these sutures are tied and cut short the bladder wall is suspended against the abdominal wall in such a manner that the edges of the vesical incision turn inward, forming a valve which much facilitates subsequent healing. This suspension also obliterates the space of Retzius and prevents the accumulation of a pool of urine on the outside of the bladder. The drainage tube is now inserted, and one or two chromic sutures inserted in the upper part of the fascial incision. These must not, however, close the wound tightly against the drainage tube. Sufficient space must be left below it for the escape of blood and urine when the lumen of the tube is occluded with clots. Two silk worm sutures partly close the skin incision, carefully leaving a little room for drainage. One of these sutures is tied around the drainage tube to secure it in place. The tube should be of rubber, and  $\frac{1}{2}$  inch in external diameter, with lateral openings cut near the inner end. The very large tubes recommended by some operators are not necessary, and they unduly prolong the convalescence. The proper length is  $2\frac{1}{2}$  to 3 inches. The tie with the skin suture prevents the dressing from pressing the end of the tube on the base of the bladder. A large pad of absorbent cotton with a single cover of gauze completes the operation.

Since abandoning irrigation I have had vastly



VERTICAL SECTION  
Fig 3

less trouble with foul bladders than when I used continuous irrigation for 24 hours after the operation, and during the after treatment frequent bladder washing. The after treatment has been much simplified. It is only necessary to change the absorbent gauze pads often enough to absorb the escaping urine. The bed covers may be protected by covering the pad with a square of rubber sheeting. The patient may be out of bed in a wheel chair on the second or third day. The bladder often closes within a few days of the removal of the drainage tube. This should, however, be retained at least ten days, as it is not well to force the urine through the vesical neck,

which at this time is covered only by granulation tissue, and complete healing of the cavity from which the pro-state is removed surely requires longer time. As this is being completed during the third or fourth week, and occasionally at long intervals afterward, it is well to be certain of maintaining a good opening in the vesical end of the urethra by the occasional passage of a sound as large as the capacity of the urethra will admit without force.

Every step of this composite operation is of importance. Carried out as described, it constitutes a logical operative procedure with highly satisfactory results.

## THE OPEN TREATMENT OF FRACTURE OF THE FEMUR

By ALLYIUS MCGILANNAN, M. D., BALTIMORE

**I**N a recent discussion of the open treatment of fracture of the shaft of the femur, the strength of the plate and the holding power of the screws occupied the greater part of the reports. This prominence was shared with studies of the endurance and the resistance of various instruments under strain. Apparently, study of the mechanical side of the subject had distracted these observers from the important fact that the union of a broken bone is a vital process, and is governed by the same laws that control wound healing everywhere.

Accurate fixation of the fragments is of great importance for the union of a fracture, and the degree of functional recovery is directly proportional to the accuracy of this approximation, but fixation is not the only factor in securing success. There are specimens in every museum like the one shown in Fig. 1, and similar illustrations are found in all works on surgery, examples of the firm healing of bone in the absence of accurate fixation of the fragments.

The healing of a wounded bone will be delayed or prevented by undue tension, by imperfect circulation, and by all the other factors that prevent or delay wound healing in general.

Therefore it seems to me that success in the open treatment of fracture of the femur does not follow greater strength of the plate and its fixation, but depends rather on carefully following the general rules for the treatment of fractures, especially with regard to position of the limb and the application of dressings. The plate is intended to act as an internal splint, one whose application directly on the bone makes perfect apposition

possible, but whose action is required only for the length of time necessary for the formation of firm callus. Tension strong enough to break or twist the Hanselman silver plate or great enough to loosen properly inserted screws is too great for primary wound healing and will interfere with bony union even if the fragments are kept in apposition by some firmer fixation. The original Lane plate, without any reinforcement, is strong enough to hold any fracture if the limb is put in the proper position.

In our recent cases the operation was performed in the manner to be described. The patient is prepared for operation by a period of preliminary treatment varying from one to ten days, during which time the broken leg is either suspended as in Fig. 2, or is bandaged to a long side splint. All handicaps to operation, i. e. heart, lung, kidney, or digestive diseases, are studied, and as far as possible compensated or removed by appropriate treatment.

Occasionally some complication is found that prohibits any operation, or a condition such as malignant tumor which indicates amputation rather than an attempt at the cure of the fracture. Syphilis, anemia, hypothyroidism, and other constitutional disturbances known to interfere with bony union must be searched for, and if found they are contraindications to immediate operation. Individuals suffering from these disorders are always poor surgical risks, and operation for fracture in these patients is sure to end in disaster unless the constitutional disease has been brought under the influence of appropriate treatment. The immediate preparation of the

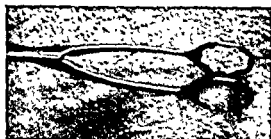
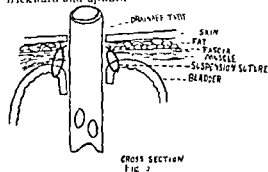


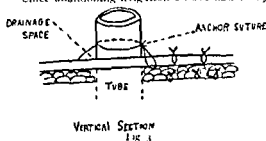
Fig. 1. Rockey's prostatectomy forceps

gland delivered in two pieces. I have sometimes separated it only in front to facilitate drawing the large gland through a small incision. The prostate now lies free in the bladder. The glove is then drawn from the left hand, and under the guidance of the left index finger, the delivery of the loosened prostate is accomplished by a pair of suitable fenestrated forceps. Formerly I used an ordinary sponge or tongue forceps. Recently, however, I have devised a special forceps for this purpose (Fig. 1). It has an oval blade with smooth edges and a scalloped fenestrum which will hold the prostate without tearing any chance bit of the vesical mucosa which might be caught in its grip. By care and a little manipulation a large gland may be quickly delivered through a small incision. The gland is soft and elongates as it is seized with the forceps, and the bladder wall is elastic. The enucleation of a large gland requires no longer bladder incision than a small one. The room required for the delivery of the elongated gland from the bladder marks the limit of the required incision. In practice I find that in thin subjects a 1½-inch skin incision and in ordinarily fat subjects a 2-inch incision is about right. In fat men, a distinct advantage in enucleation may be gained by having the assistant place both hands flat just above the incision, and press the belly wall backward and upward.



After the delivery of the gland, the valvular suspension suture (Fig. 2) is introduced. I regard this as a most important step in expediting recovery. The edge of the wound on one side is held back by a small retractor. A Robeson needle threaded with No. 3 catgut is passed through the fascia and muscle. The left index finger is introduced into the collapsed bladder and hooks it up and brings it into the opening. The edge of the bladder incision is seized with a toothed hemostat and drawn out until the needle can be readily inserted half or three quarters of an inch from the margin of the incision. The needle then dips in and out of the bladder wall, and then up through the muscle and fascia. A similar stitch is inserted on the other side. When these sutures are tied and cut short the bladder wall is suspended against the abdominal wall in such a manner that the edges of the vesical incision turn inward, forming a valve which much facilitates subsequent healing. This suspension also obliterates the space of Retzius and prevents the accumulation of a pool of urine on the outside of the bladder. The drainage tube is now inserted, and one or two chromic sutures inserted in the upper part of the fascial incision. These must not, however, close the wound tightly against the drainage tube. Sufficient space must be left below it for the escape of blood and urine when the lumen of the tube is occluded with clots. Two silkworm sutures partly close the skin incision, carefully leaving a little room for drainage. One of these sutures is tied around the drainage tube to secure it in place. The tube should be of rubber, and ½ inch in external diameter, with lateral openings cut near the inner end. The very large tubes recommended by some operators are not necessary, and they unduly prolong the convalescence. The proper length is 2½ to 3 inches. The tie with the skin suture prevents the dressing from pressing the end of the tube on the base of the bladder. A large pad of absorbent cotton with a single cover of gauze completes the operation.

Since abandoning irrigation I have had vastly



employing the smallest amount of force, therefore the resulting degree of shock is less than when other forms of traction are used.

The weight of the body furnishes sufficient counter traction in recent fractures. When dealing with an old fracture we fix the limb by means of a rope of gauze passed over the groin and under the thigh, and tied to one leg of the operating table.

*The reduction.* While the traction and manipulation are carried on, the upper fragment may be held in a lion-jaw forceps, and further manipulation made with this, or by means of the Lane femur elevator or an ordinary periosteal elevator. Sometimes all of these instruments are used at once, with the aid of a competent assistant. If possible the fragments are now held in a Lowman or some similar bone clamp, or else the lion-jaw and other instruments are still kept in place until the plate is fixed.

In all these maneuvers especial care must be given to the preservation of the periosteum. This membrane is the source of the greater part of the new bone that makes perfect healing of the fracture. It should neither be stripped from the fragments nor violently torn or crushed by the clamps and other instruments.

*The plate and its fixation.* The length of the plate must vary with the character and position of the fracture. We aim to use a plate long enough to have the screws inserted at least 2 cm. from the edge of the fracture. As a rule, one screw in each fragment is sufficient, but when the fragments show a tendency to rotate, two screws should be put in one fragment if not in both. The length of the screws will vary with the object of their insertion. When the cortex of the bone is of normal density and thickness, it is best to use a short screw, one that penetrates the entire thickness of the cortex after passing through the plate. When the cortex is thin or less compact than normal, a screw longer than the diameter of the medullary cavity should be used in order to obtain greater strength of fixation by penetrating the cortex on the opposite side.

The relative advantage of the silver or steel plate is open to discussion. The rigidity of the steel plate is of great value in preventing bending or twisting movements of the fragments during the application of the external fixation dressing. Long experience has made surgeons look with favor on silver as the best metal to be buried in the tissues. The anti-septic action of this metal in colloidal solution more than balances the advantage of iron, that is, a metal whose salts are normal constituents of the body.

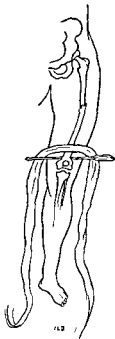


Fig. 3 To show the direct traction on the lower fragment. The long drill transfixes the femur near the condyles and the rope of gauze passes over the front of the thigh and around the end of the drill.

Our own results have been equally good with both forms of plates, although we have had more experience with silver. The great advantage of steel over silver plates seems to be in the fact that in the former a smaller weight and volume of metal is necessary to obtain the same degree of fixation.

*Closure of the wound.* All hemorrhage from the soft parts must be controlled before the wound is closed. Some oozing from the bone will persist, but if the wound is otherwise dry the tissues will take care of this. Torn periosteum is first replaced and sutured to similar flaps or under suitable muscle surfaces. Muscles are coapted and the fascia carefully sutured. Catgut is the best material for these deep sutures. The ends of these catgut sutures are left long and brought out through the skin in order to afford drainage for any oozing in the wound. The skin is closed with a subcutaneous silver wire.

*The dressing.* The wound is dressed with aseptic gauze, and the limb padded with sterile material. Over this an ordinary bandage is quickly applied, in the turns of which a number of thin strips of splint wood are incorporated, for the purpose of equalizing pressure and aiding

the circulation. Then a plaster of Paris cast is put on, running from the toes to the nipple line. This cast is moulded well around the knee and over the pelvis and hip. A suspension apparatus or support, or a special table like that of Dr Downey<sup>1</sup> will be found useful in applying the cast.

The position of the limb in this dressing depends on the site of the fracture. "The limb is placed in that position which inclines the fractured portions nearest a normal line, and most effectually relaxes the muscles of the limb."<sup>2</sup> When the fracture is in the upper third of the bone, the thigh and leg are partially flexed and the thigh slightly abducted. With a fracture of the middle third, the limb is put up straight. When the bone is broken in the lower third the knee is half flexed and the hip is flexed enough to bring the heel and the sacrum on the same horizontal plane when the patient lies on his back.

*After care.* The dressing is not disturbed for three weeks, unless the wound demands attention before this time. In the latter event, a window is cut in the plaster and the wound inspected and dressed through this opening. After three weeks the cast is gradually cut away from above and below until at the sixth week there remains only a cast extending from the pelvis to the knee. After eight weeks the knee is freed, and all fixation is removed at end of ten weeks. During last four weeks the patient may be about on crutches.

We give five grains of thyroid extract once a day from the third to the sixth week, and

give iron and calcium the succeeding four weeks. As soon as any portion of the cast is cut away, the exposed parts are massaged daily and any free joints given passive motion. With children or thin adults it is better to remove the entire cast after the third week and apply a new one, after giving the limb passive motion and massage. This dressing and manipulation is repeated every two weeks until the tenth week.

*Results.* Our results have been uniformly successful as to permanent cure and function. In one case a large hematoma developed in the wound and required evacuation, delaying the healing of the soft part wound. We have had no infections nor any case of non-union.

*Tolerance of the tissues for the plates.* We have not removed the plate in any of our cases. This has been the result with most operators in cases of fracture of the femur. With the more superficial bones, as the tibia or ulna, etc., the plates are more likely to require removal. In a series of 26 plated fractures of 29 bones we have been compelled to remove the plates in two cases—one from the tibia and the other from the olecranon. Tolerance for the plate varies directly with the depth of its position in the tissues: the further from the skin it is placed, the greater the ease with which the tissues accommodate themselves to its presence.

*NOTE.*—Since writing this report we have removed a Lane plate from the thigh on account of sinuses three months after the original operation.

## AMPUTATION FLAPS

By JABEZ N. JACKSON, A. M. M. D., KANSAS CITY, MISSOURI

**T**HE flap of an amputation in the extremities as described in all our works on surgery consists of the skin and superficial fascia, down to but not including the deep or muscular fascia. This flap, however fashioned, is dissected from the underlying deep fascia over the muscles and turned back. The deep fascia and muscles at the higher plane are divided by a circular sweep, and amputation completed. In closing the wound the flap is brought down over the ends of the cut muscles and sutured (Fig. 1). In healing, the cut end of muscle unites with the under surface of the superficial fascia, an anatomical condition nowhere presented in nature. If the muscles

about the bone are divided comparatively high or later contract and retract, the end of the bone is shoved forward, covered only by superficial fascia and skin, and a conical stump results (Fig. 2). Ofttimes even the superficial fat is absorbed and the skin is practically tight over the end of bone.

Again retraction takes place in the center over the bone (Fig. 3), and we have a fossa accumulating dirt and engendering infection and irritation. Such stumps often give trouble. They are never anatomical.

To meet this criticism we have for nearly ten years employed the following plan. Flap fashioned as preferred, the incision is carried down through skin and superficial fascia to deep mus-

<sup>1</sup> J. Rec. of Med., Feb. 1908.

James The Lancet vol. III 1346 p. 215.

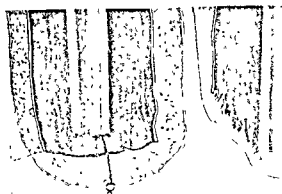


Fig 1



Fig 3

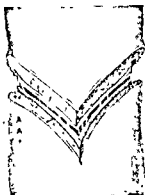


Fig 4

cular fascia. Allowing ordinary skin retraction the deep or muscular fascia is incised in same line (Fig. 4). The flap consisting now of (1) skin, (2) superficial fascia, and (3) deep fascia is now

dissected back by cutting into muscle substance. We usually prefer to cut obliquely through the muscle, making a conical flap (Fig 5). After amputation is completed and hæmostasis secured, a few deep catgut sutures approximate muscles to close up dead space. The flaps are now brought down over the end of stump, the deep fascia identified and sutured (Fig 6) by continuous (or interrupted) catgut stitch — just as the rectus fascia is closed in the modern tier closure of the abdomen. This covers all raw muscle ends by fascia (Fig 7) as nature originally planned. The skin incision is now closed by separate line, using whatever suture method or material one may elect.

*Advantages* (1) Anatomical, muscle covered by deep fascia, skin separate and movable. (2) No retraction of skin and formation of creases or fossæ for dirt. (3) Fascia holding muscles uniformly over end of stump prevents fascial retraction and conical stump. (4) Bone covered by muscle and fascia, preventing fixation to skin.



Fig 5

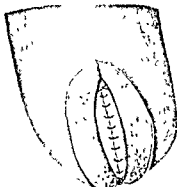


Fig 6

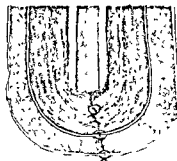


Fig 7



## THE AMERICAN COLLEGE OF SURGEONS

At the New York meeting of the Clinical Congress of Surgeons of North America in November 1912, Franklin H. Martin asked that a committee be authorized by the Congress to consider the advisability and practicability of establishing a strong continental association of surgeons to be known as the American College of Surgeons, the object of which should be to elevate the standard of surgery on the American continent and to grant a fellowship in such an organization which would indicate that the possessor of such fellowship in the opinion of his peers was thoroughly qualified to practice surgery.

## THE COMMITTEE

Such a committee with full power to act delegated to it was appointed by the President of the Congress, Edward Martin of Philadelphia. The committee appointed, of which the President is a member ex officio is thoroughly representative and consists of Edward Martin, Philadelphia; Emmet Rivford, San Francisco; John B. Murphy, Chicago; Rudolph Matas, New Orleans; Albert J. Ochsner, Chicago; Charles H. Mayo, Rochester; Minn. I. J. Cotton, Boston; George Emerson Brewer, New York; John M. I. Finney, Baltimore; W. W. Chapman, Montreal; George W. Crile, Cleveland; and Franklin H. Martin, Chicago.

## PRELIMINARY PLAN FOR ORGANIZATION

Immediately after the adjournment of the Clinical Congress, an Illinois charter was obtained which secured to the organization the legal right to the name of American College of Surgeons. The applicants for the charter were Murphy, Ochsner and E. Martin. The members of the provisional Corporation are Brewer, E. Martin, Murphy, Ochsner and F. Martin.

The present plan of organization, which of necessity is provisional, subject to confirmation by the corporation when organized, is as follows:

## CORPORATION OR COLLEGE

The founders of the Corporation shall be selected from all departments of surgery in the recognized medical colleges, both graduate and undergraduate, of the United States and Canada, and such other surgeons as the organization committee may designate.

## BOARD OF GOVERNORS

An executive committee of fifteen or more should be elected by the Corporation at its first meeting and provision made whereby they may be divided into classes with terms of service terminating in one, two and three years as their successors are selected. This executive committee, it has been suggested, should be known as the Board of Governors, and their duties shall be similar to those usually performed by a board of trustees.

## FELLOWS

The Fellows shall consist of (a) the several thousand surgeons of whose standard of surgeons there is no doubt and who have been or are now practicing surgery; (b) other medical men, who are graduates in medicine, and who will qualify themselves according to the organization requirements; (c) younger graduates in medicine who through supplementary work furnished by their own schools or graduate schools, have met the requirements of the organization. The fellowships are to be conferred from time to time by the Corporation on recommendation of the Board of Governors.

## PRESENT PLANS

It was proposed by the organization committee that it should proceed at once, through its Chairman and Secretary in co-operation with members of the committee in the separate localities to invite by means of conference and correspondence the members of the original Corporation and to arrange for a preliminary meeting of the Corporation in Washington on May 5, 1913, the day preceding the meeting of the American Congress of Physicians and Surgeons, at which time the original committee will recommend a plan of organization to this large foundation body. This meeting will then effect a permanent organization.

## WHAT HAS BEEN ACCOMPLISHED

During the week of January 20 in pursuance of the above plan, the Secretary of the Committee Franklin H. Martin, made a preliminary canvass of the eastern seaboard cities. Meetings had been arranged in advance by the local committees, to which were invited the heads of departments of surgery in the medical colleges and other leading surgeons in each of the following cities: Washington, Baltimore, Philadelphia, New York, Brooklyn and Boston. Subsequently Toronto, Montreal and Cleveland were visited, where similar meetings were held. On March 6 a similar meeting was held in Los Angeles and immediately following this was a series of meetings, including San Francisco, Portland, Seattle, Vancouver, Winnipeg, Minneapolis, St. Paul, Kansas City and St. Louis. The other important cities of the United States will be canvassed during the next four weeks.

In each city the preliminary plans of the committee were outlined and a free discussion was invited and obtained. Every man attending the respective meetings was given an opportunity to formally declare his willingness to accept an invitation to become one of the founders of the Corporation of the American College of Surgeons, and to be present at the meeting for organization which will be held in Washington at the New Willard Hotel on the evening of May 5, 1913.

This preliminary canvass has resulted in more than 350 of the leading surgeons of the United States and Canada declaring themselves ready to accept invitations to become foundation members of the Corporation.

It is the intention of the committee to pursue this plan of visiting personally, where possible, all the college and university cities of importance in the United States and Canada, and of obtaining in this careful manner a list of five hundred of the leading surgeons from all sections of the continent who will come together and consider the best ways and means of accomplishing the ends for which the committee was appointed, and to form themselves into a governing body of such strength and influence that their authority will be unquestioned.

With this strong corporate body of leading surgeons of the continent and with a fellowship of several thousand surgeons of whose ability there is no doubt, it will be an easy matter to establish a minimum requirement for beginners in surgery that will be welcomed and executed by the worthy educational medical institutions now in existence. When the requirements have been fulfilled, either by the beginner in a supplementary course in hospital and operative work, given by the school from which he receives his medical degree or by the older practitioner who takes a supplementary post-graduate course from a distinct graduate school, he will be made a Fellow of the College.

With a powerful fraternal body like this working in perfect harmony and co-operation with all the educational institutions on the continent, the matter of still further increasing the influence of the Corporation through congressional, parliamentary, state or provincial legislation will be entirely a matter for the Corporation to decide.

First, secure an organization backed by the best surgeons in the United States and Canada as governing members, through this develop public opinion in the laity and the medical profession for a higher standard of surgery, and then ask for the legal machinery that will bring about reforms that are not already controlled by the influence of the new public opinion.

#### SUMMARY OF VIEWS

The following ideas and suggestions as regards the organization were brought out at the meetings in Washington, Baltimore, Philadelphia, New York, Brooklyn, Boston, Toronto, Montreal, Los Angeles, San Francisco, Portland, Seattle, Vancouver, Winnipeg, St. Paul, Minneapolis, Kansas City and St. Louis.

1 The organization must be independent of all societies, all congresses, all universities or schools.

2 'While independent, its governing body must consist of the leading surgeons in all departments of surgery from all the leading general and special societies and the accepted teaching bodies.'

3 'With a central controlling corporation of this kind, its strength and influence will be such that its motives cannot be questioned, its rulings will be authoritative, its fellowships will be sought for and its influence will be respected.'

4 'The granting of its fellowships should be open to all competitors in surgery, without favor. Scientific attainments measured by the Corporation's standard and backed by unquestioned moral character should constitute the requirements of a fellowship.'

5 'There should be four classes from which the Fellows should be selected at the beginning.

(a) A large group of surgeons of sufficient reputation and attainment in surgery, of whose surgeonship there is no question, who should be carefully selected by the Corporation and invited to become Fellows without formal examination.

(b) Men who are not of sufficient reputation to receive an invitation under

(a), but who may apply for fellowship. They should be passed upon by examination or otherwise by committees on Examination and Credentials.

(c) Recent graduates in medicine, of sufficient age, who are desirous of fellowship and who apply for admission to fellowship. Of these, those who can produce advanced credits recognized by the organization which are furnished by medical schools also recognized by the organization, and give satisfactory evidence that they have been in the practice of medicine a sufficient length of time, are to be received without examination.

(d) All other recent graduates, viz, those graduating from schools not giving the satisfactory advanced course in surgery required by the organization must give satisfactory evidence to the committee on Credentials of practical work done and submit to an examination."

6. "The organization should be inclusive and not exclusive in its methods. It should be a popular democracy with a membership based upon efficiency, rather than an exclusive aristocracy based upon position."

7. "The principal object of the College should be to elevate the standard of surgery by utilizing to its maximum the machinery of the existing teaching institutions in order that our prospective Fellows can obtain training without undue hardship."

8. "We must urge all surgeons of prominence to become Fellows in order to magnify the importance of the College to the unknown man, and thus induce him to qualify in surgery and seek its stamp of approval."

9. "The ceremonies of the College in the granting of fellowships should be of an impressive and dignified nature in order to increase its prestige with the profession and the laity. Convocations should be held in the spring and fall, when scientific or educational addresses should be delivered by foreign or local surgeons of note, when prizes should be awarded, as the College in time establishes such prizes through endowment or income, and when the fellowships should be granted by the President of the College under the direction of the local members of the Corporation."

10. "A Blue Book in the form of a directory should be published each year which will give the names by states and cities and the addresses of all Fellows. This should be on the desk of each Fellow to be used as a guide in recognizing the men of approved qualifications in each state and province on the continent."

11. "The finances of the Corporation should be independent. A fellowship fee of \$10.00 should be required. No annual dues should be necessary, because of the fellowship fees to be paid by new members each year, except it be a \$2.00 fee for an annual directory."

12. "As the Corporation will bring its influence to bear by co-operating with the medical schools and societies now in existence, and as the medical schools are all properly chartered under state and provincial laws, and as there is not as yet a national corporation law, the only charter that this Corporation will require is one under a state law, under the act 'not for pecuniary gain'."

13. "As this organization contemplates a Continental plan rather than an exclusive United States plan, it has been suggested that the name be 'North American College of Surgeons' or 'American College of Surgeons' with a suffix '(U.S.)', '(Canada)' or '(Mexico)', or with a graduate college designation, as 'American College of Surgeons, (McGill)', '(Harvard)', '(Johns Hopkins)', etc."

14. "As public opinion is more potent in influencing the public than the strongest laws, this great fraternal body should bring its influence to bear upon the profession and laity through the creating and maintaining of proper public opinion."

# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD DECEMBER 6, 1912, WITH THE PRESIDENT, DR. CHARLES DAVISON,  
IN THE CHAIR

### A SYMPOSIUM: CLASSIFYING AND STANDARDIZING SURGICAL PRACTICE

A METHOD OF CLASSIFYING AND STANDARDIZING SURGICAL PRACTICE. BY ALLEN B. KANAHEL, M.D.  
THE POST-GRADUATE PREPARATION AND LEGAL REGISTRATION OF THE SURGEON BY CHARLES  
DAVISON, M.D.

THE NEED OF PROFESSIONAL AND LEGAL REGULATION IN THE PRACTICE OF SURGERY. BY COLEMAN  
G. BUTFORD, M.D.

### A METHOD OF CLASSIFYING AND STANDARDIZING SURGICAL PRACTICE

By ALLEN B. KANAHEL, M.D., CHICAGO

THE surgical skill of Mott, McDowell, Sims, Gross, and our own Senn and Fenger, with scores of others, has made American surgery respected wherever surgery is practiced. These men, however, were the exceptional practitioners who by industry and study gained a mastery, and were recognized as especially qualified above their fellows to practice that branch of our science.

In this later day, the whole plan of education has changed. The medical schools have elevated their general standard, without in like manner raising the requirements for surgery. Our students all receive the rudiments of surgical knowledge, and are led to believe that in a four-year course they have had the training it took our Motts and Senns a score of years to acquire by closest application. The technique of surgery is mistaken for the science of surgery. The student of medicine must now actually percuss, palpate, and auscultate, he must himself examine the secretions and excretions, he must actually take part in obstetrical deliveries. But the surgical student may still go out and practice this branch with only a dissecting knowledge of anatomy, a post-mortem knowledge of pathology, and a theoretical knowledge of the mechanics of surgery. We, as teachers, give our diplomas and

tacit recommendation to graduates, saying that they are qualified to practice surgery, when they have never actually held a surgical scalpel, when they do not know the feel of an engorged appendix and when their only knowledge of an inflamed gall-bladder comes from the description of an operator.

The fault is not that of the student when he attempts surgery. It is ours that we do not set some standard by which both he and the public may know that he is qualified to practice. Therefore, it would seem that we as surgeons should:

*First* Outline by what methods and in what manner the student may become properly equipped to practice surgery.

*Second* Designate what qualifications the student should have before we recommend him as competent.

*Third* Formulate some method by which the public may learn who is considered so qualified.

Should this be done by legal restrictions or by education of the profession and the public? This is a legitimate question for discussion. Against seeking a method by law, it may be urged that the endeavor would be misunderstood, and improper notions imputed by both the profession and the public. The process would be a long one, and even then possibly not successful. Would it not be better to devise some means of

public and professional education which would compel the surgeon to equip himself so that he might practice with safety to his patient and credit to himself? To do this, the following plan may be suggested as a working basis.

A committee may be appointed by this body to confer with other organized surgical bodies and medical schools upon the following propositions.

First. What education should be necessary for a surgeon?

Second. Should a special honorary degree be awarded which would stamp the holder as qualified to practice surgery?

This committee should have the broadest of instructions and be asked to convey to us at a later date the result of this investigation.

The standard requirement may be worked out along the line of the number of years the physician has practiced, his various assistantships to surgeons, internships, and special study. The fellowship should be granted by a central committee made up of the recognized men from all recognized surgical organizations, this committee forming itself into a college for that purpose. This group then may grant a fellowship upon investigation, examination, or recommendation

by recognized surgical organizations or medical colleges.

The individual having this degree is thus stamped before his fellows and the world as one qualified to practice. It is my personal opinion that the force of this would be greater if, upon receiving this fellowship, the recipient would be required to drop the appellation of doctor and be known after the English custom as "Mister," followed by the letters signifying his fellowship. Thus the man who wishes to practice surgery as a specialty must cease to advertise himself as a physician, although he would not by law be prohibited from treating medical cases, and, conversely, the man who wishes to continue in active medical practice would not apply for the degree, and hence could not advertise himself as a surgeon, although there would be no legal bar to his practice of surgery. A general knowledge of these facts would soon enable the public to distinguish between the specialties, and force each man to choose for himself whether he wished to be known as a physician or a surgeon. If the latter, he would realize the value of properly equipping himself and attaining the degree which would be evidence to the public of his competency.

## THE POST-GRADUATE PREPARATION AND LEGAL REGISTRATION OF THE SURGEON

By CHARLES DAVISON, M. D., CHICAGO

THE practice of surgery has grown so rapidly in the last few years that its relationship to the community is not on a stable basis.

The practice of surgery as a specialty has been singling itself out from the other branches of medicine in a remarkable manner.

The achievements of good surgery are so brilliant, the results so satisfactory, and the emoluments reputed to be so rich, that it presents a field intensely alluring, alike to the ambitious and reckless novice, to the mercenary and unscrupulous general practitioner, and to the smooth and polished surgical exploiter, who performs unnecessary operations to obtain the fee, who makes his living by humbugging and defrauding credulous and suffering humanity.

Unskilled and ill-judged attempts at the practice of surgery lower the prestige of surgery and the prestige of every reputable surgeon within the radius of its publicity.

Unskilled and ill-judged operations give poor results, and those of the laity who are familiar with individual bad results are slow to avail themselves of surgery, even when it is necessary, when it is health-giving, when it is life-saving.

The laity has seen its friends and relatives, suffering with trivial diseases, die under the knife of the novice or incompetent, and shudders with apprehension at the mention of surgery.

Every unnecessary operation, every ill-judged operation, every badly executed operation, every operation followed by bad results, casts a certain amount of odium on good surgery and limits the usefulness of capable surgeons, both to themselves and to their fellow-men. There are many faults in the practice of surgery, some lying at our door, some outside of our ability to control.

It seems that it is time for us to take an inventory and find where we stand.

It is a common thing for a man to graduate

from a medical college, enthused with his theoretical knowledge of surgery, enthused with his ambition to imitate his surgical clinical teachers, anxious to rival his previous classmates, anxious to make good in his profession, but without practical surgical training

He has seen many operations from the benches. He may have stood by the patient during an operation a few times, capped, gowned and important, but as a student he has probably never reached the stage of personal sterile preparation for an operation. He has never had his hand in the field of a capital operation.

That young graduate, backed up with a diploma from one of our first universities, but with that lack of experience, may be the one to go out and pose before the public at once as an accomplished surgeon.

He may be ready to operate upon the first surgical case that he can land, no matter how serious or vital the operation may be.

If it is an important abdominal operation, it is the more alluring to him. His mistakes in judgment or technique are covered by a kindly peritoneum or the grave. This man has a legal right to do surgical operations of any kind as soon as he has passed his examination and has been licensed to practice medicine and surgery by the board of health in the state in which he resides. He can obtain this legal right to do surgical operations although he may never actually have done a surgical operation in his life, although he may never have been the actual assistant of a recognized surgeon for a single day. He can obtain this license to practice surgery without having been an assistant to any surgeon or interne in any hospital of any kind. He can obtain this license to practice surgery without practical experience of any kind. These things are possible with the recent graduates of our best universities.

The recent graduates of some of the medical schools of lower grade, where the preliminary educational requirements are a farce and the professional course is weak, are entitled to the same legal privileges as their more theoretically proficient brothers.

It is the general practitioner without surgical reading, training, or experience who is the greatest offender.

It is the family doctor who is successful as a general medical practitioner and who knows little of surgery, who does one, two, or three operations a year—it is he who is doing the damage to the reputation of surgery.

The damage is great, because there are so many of this class of offenders, each doing a little. The

family doctor has the confidence of his patients. He is intrenched by his medical successes with them, by his long acquaintance with the family, and by his experience in dealing with people. The influence of the family doctor decides who shall be the surgical operator in the majority of cases.

The family doctor, according to his own ideas and inclinations, can refer the case either to a competent operator, appropriate to the case, or he can make the attempt to operate on his patient himself, or he can divide the responsibility with some brother practitioner of equal ability but more audacity. The patient will usually approve of either disposal.

It is a matter of common knowledge that groups of family doctors are doing elective capital surgery in a mediocre manner in kitchens in small towns and rural districts all over the country, with varying results. The bad results are charged by the laity to surgery as a whole, not to individual incompetent attempts at surgery, which these results represent.

The hospital, modern and well equipped in all its departments, furnishes the most glaring examples of the surgery of the family doctor. The competition of hospitals for patients is so great that any general practitioner of good standing in the community may bring his patients to almost any hospital and operate on them himself, with good assistants, good equipment, and good surroundings, on some patients with success, on some with failure.

In occasional cases the friends of the patient remain in the reception room while the family doctor operates, with the assistance and co-operation of the interne, that is the interne with a few months' experience does the work, with the exception possibly of the initial incision, while the family doctor looks wise, and holds a bloody sponge, and later shows the surgical relics to admiring friends of the patient.

In other hospital cases the general practitioner operates personally on his cases, but does it in such a tedious and clumsy manner that the patient becomes exhausted before the operation is complete.

For example, a patient apparently in robust health, a woman in early life, the mother of a family, walks into a hospital to be operated upon for prolapse of the uterus, a resultant of childbirth. Her family doctor—the doctor who brought her babies into the world, the man in whom she has confidence—operates upon her for three hours and forty-five minutes<sup>1</sup>. She lives fifteen minutes after being returned to her bed.

The operating surgeon should be equipped by proper experience and proper training before he begins his career as an independent operator.

He should serve an internship in a general hospital.

He should have done general medical practice for a sufficient time to establish good judgment in diagnosis, and to learn what the human body will stand when in trouble from disease.

He should have been an active assistant for a good length of time to some surgeon of established ability and practice, or else he should have been trained as a surgeon by post-graduate study and active operative experience in a hospital especially equipped for that kind of service, with the active supervision of a competent surgical teacher for a length of time sufficient to establish surgical judgment, operative technique, and manual dexterity.

Surgeons who have had these kinds of training and experience should be marked out from the general profession and labeled in such a manner that the common people can distinguish them as competent and safe operators.

This may be accomplished along two lines: by education and by law.

1 The conferring of appropriate degrees by the graduate schools of the universities that conduct 'A grade' medical schools. This could be made effective if the standard universities would put into their graduate schools the proper course of instruction for the surgical education of students who are already graduates in medicine — if the universities would train these men in the hospitals under university supervision until the establishment of actual

operative proficiency, and then grant a diploma from the graduate school of the university, conferring a distinctive surgical degree.

This course should be of sufficient grade in time and character so that the surgical degree would equal in prestige the other doctorate degrees given in course in the graduate schools of the different universities. When this has been done our ideals will have been accomplished.

2 The legal registration and licensing of surgeons and their supervision by state boards of health.

This could be made effective if the medical practice acts of the different states could be amended so as to give the state boards of health the power to license doctors of medicine to practice operative surgery when they had properly prepared themselves by post-graduate work and experience.

It is suggested that this preparation shall consist of: (a) five years of general medical practice, (b) five years of surgical experience, to be made up from (1) service as interne in a general hospital, (2) service as assistant to a surgeon of recognized ability, (3) service as assistant surgeon on the staff of a general hospital; (4) service as teacher or instructor in any department of surgery in a recognized medical college, (5) post-graduate surgical study in any standard institution, regularly recognized by state boards of health, (6) the five years of surgical experience may overlap the five years of general practice.

The primary registration would necessarily exempt from these requirements all medical men already doing operative surgery.

First attention to emergency surgery would necessarily be exempted from the operation of any law.

When the operating surgeon is labeled by a university surgical degree and licensed by the state board of health, the laity will have a guide in selecting the surgeon, and there will be an improvement in the end results of surgery.

## THE NEED OF PROFESSIONAL AND LEGAL REGULATION IN THE PRACTICE OF SURGERY

By COLEMAN G. BUFORD, M. D. CHICAGO

EVERY profession has its defects in qualifying its members, as well as its incompetents. The pulpit is filled with those whose theology, eloquence and rhetoric are not attracting attendance, the bar shows frequent examples of the loss of just causes through lack of elementary knowledge of court procedure. I believe that the profession of medicine is doing vastly more than any other profession to improve the quality of its recruits and its members, and further believe that careful review of those leaving academic work and entering the various professions and pursuits will show the highest percentage of proficiency and finest examples of

manhood and womanhood among those entering upon a medical career.

In the performance of the world's work, each profession and pursuit and each highly specialized branch of either must be depended upon to find its own defects, and to purify and perfect itself in the interest of common welfare. Prompted only by these high motives, this highly specialized body has assembled to discuss ways and means of better preparing the surgeons and better regulating the doing of surgery by those who are to follow, in the interest of common good.

It is so apparent to surgeons themselves that their special branch of medicine needs some pro-



professional and legal regulation that it seems almost superfluous to discuss the subject here; yet if anything is to be accomplished in the way of legalizing practice by the fit and prohibiting the practice of major surgery by the unfit, it is necessary for this question to take form, to thus afford opportunity for discussing it, and through such discussions promote the formulation and enactment of just laws directed toward the end we have in view.

The present laxity is due to social conditions existing in every new country, defects in medical education, the open hospital, loose methods of making hospital appointments, management of hospitals by untrained superintendents, and deficient legal control of hospitals themselves.

Medical education has received severe criticism in the last few years, and while I sanction this criticism and believe it will result in the most rapid improvement in our educational system, I also believe the system of the past will bear the last analysis without any great reflection being thrown upon our profession, for it must be remembered that in our country the laity have not borne their part of the burden of maintenance of medical schools until recent years. Both the work and the expense have been largely borne by the profession. Furthermore, in this new country of wide expanse, physicians were required to follow upon the trail of settlements bound ever westward. Because of the great distances to be covered by physicians in each locality, the work of each was arduous and limited, and in order that a sufficient number might be produced willing to follow upon this westward trail, there was a natural demand for more medical schools, usually poorly equipped, resulting in an overabundance of medical men remaining in the more eastern centers. We are destined to go on with this apparent overproduction to fill the gaps in the Orient which is now opening up to civilization, though we send them poor doctors, they are better than no doctors at all.

On account of the diminishing frequency of disease, shortness of illnesses, the greater uniformity of settlement of our own country, and the improvement in transportation facilities, the field of usefulness of each practitioner has been increased and the local demand satisfied, already thought has naturally turned from that of production of numbers to that of quality. At the right time this question will automatically adjust itself.

The past system of medical education in America may be justified by the theory that nothing exists without need for it, and the present efforts at revolutionizing medical education may be

similarly justified by the theory that nothing remains when use for it ceases. Medical education has been and will continue to be, in a sense, a national industry, developing spontaneously and sporadically. It has been the custom of our country to take little notice of any of its infant industries, but upon nearing their maturity to regulate them. Medical education has begun to feel this influence, and, as the result of legislation, is beginning to assume a selective rôle in the choice of those who may even enter upon the study of medicine, with a view of producing the best brand of doctors.

The educational qualifications of medical men of each decade have perhaps been equal to those of other professions of their time. The finding of inferior men in any field does not necessarily mean they were originally poorly qualified, for their environment and fitness for the struggle have had largely to do with the final product. Though we educate all of our men in the finest fashion, and enact every conceivable law, there will remain in the final shakedown those who, as time goes on and civilization and knowledge advance, will be relatively as poor practitioners of medicine and surgery as there were in the days of our forefathers.

Up to thirty years ago the field of surgical possibilities was rather limited. The surgeon's work was largely done by the physician, who dealt with accidents and, surgically, with comparatively few other diseases or conditions. On account of the rapid development of pathology, improvement in our diagnostic ability, and the advent of antiseptics and asepsis, one affliction after another has become amenable to treatment by operative surgery. The scope of surgery has so increased that one must be specially trained in diagnosis, technique, dexterity, temperament, judgment, and conscientiousness to give the uniformly good service expected of him.

The present generation has had a more extensive surgical training in school than their predecessors. Their instruction has consisted of didactic lectures, operative surgery on the cadaver and on animals, and clinical instruction.

Didactic lectures have rarely covered the entire field of surgery, because of lack of allotted time, the instruction on the cadaver has not been uniform in the different schools, because of the irregularity of requirements and of material. The quarters allotted to this department have often been unsanitary and cold, and the material often dry and poorly preserved, thus not encouraging careful study. The student dealt with normal structures, instead of abnormal as met at the

operating table. Work on animals has been limited in amount, and has had to do largely with visceral surgery, the broad field remaining which could have been taken up in classwork is hardly comparable to human surgery. Most surgical clinics have been small, with great irregularity in the amount of material. This has been due largely to poor departmental organization. The school has boasted more of its numerous professors of surgery and numerous surgical clinics than of their quality. This custom has divided institutional approbation, and thus divided the clinical material returning to the teaching body, but it is rapidly giving place to that of better organization, with one head of the department, and I hope soon to see this more general. I hope also to see the return of the half-day chief surgical clinic instead of that of two hours. The half-day clinic alone affords adequate time for a really instructive clinical lecture, a creditable number of operations, exhibition of patients previously operated upon to illustrate post-operative courses and after care, presentation of non-operative patients, and gross and microscopic specimens. The field of surgery is so broad, and symptoms and procedure so variable under differing conditions, and the number of hours in which a student may attend surgical clinics are so few, that a wealth of material should be presented. The full half-day clinic offers the best solution for economizing the time of the students by doing away with the great losses of time in shifting from one clinic to another, whether in the same place or not, and the centralization of clinical teaching tends to avoid duplication of clinical lectures, which has heretofore been one of the greatest sources of waste of the time of students. The entire clinical organization should be so perfect that the chief clinic would be first supplied with abundance of teaching material.

Civil operative surgery is performed in private homes, hospitals, dispensaries, and at such places as emergency demands. The home operation is rapidly ceasing to be insisted upon by patients and their friends, because of a better knowledge on their part of the greater safety afforded in the hospital.

Those engaged in doing civil surgery are: general practitioners, contract and civil employes, trained surgeons who have no institutional connection, and those who have.

The preparations from which those doing surgery develop are: Recent graduates without experience as interne or assistant, recent graduates with experience as interne or assistant or both, very long assistantships, post-graduate

study with or without previous interne or assistantships, recruits from emergency services, those who have gradually grown into surgery while doing general practice, and those who have concluded after some years of general practice to do their own surgery and that of others if permitted.

The recent graduate without an interne or assistantship is not qualified to undertake very much of major surgery. He is not sufficiently familiar with the identity of normal structures, and can rarely deal with the pathologic with intelligence. He is too eager to operate. On account of changing conditions he should henceforth not be legalized to practice major surgery.

Recent graduates having had interne or assistantships are usually qualified to undertake most surgical work at the completion of their services. They should avoid, for their own good as well as the patients, all very difficult or complicated work about which they know little or in which they have had no experience. Those who have served extensively under qualified men are so trained in good judgment and conscientiousness that they are quite willing to have a more experienced person operate for them, or with them, or to operate under supervision. This class of men can be trusted. But it must be remembered that a mere interne or assistantship does not in itself qualify. Who is the candidate for the title of surgeon? What his alma mater? Who his teacher? What was his hospital? What was his time of general as well as surgical service? What was the volume of work in which he took part? Who his chief? These will better tend to settle the question of his efficiency.

Internships followed by long assistantships unquestionably develop the most efficient surgeons. Medical visitation and post-graduate work are relatively more beneficial to this type of men than to those less trained.

Of those who attempt to become surgeons through post-graduate study without either interne or assistantship, a very small percentage arrive. I have little faith in this method, because the student observes at long range—he sees poorly, feels nothing, and is not forced into activity, judgment, and forethought. He is not a part of the machine doing the work, he does not co-operate in the after care. Post-graduate courses of a few weeks or even a few months should not entitle men to misleading certificates of proficiency, and though mildly worded, as they hang on the wall, most such certificates are misleading.

Recruits from civil and other emergency services without previous interne or assistantships

are usually trained in their branch only, which forms a small part of private surgical practice.

Past generations have shown many examples of good surgeons gradually developing while doing general practice; special emphasis should be put upon the *gradual*. This type of men did good surgery for their time, but with the field ever broadening and the tendency of the times calling for apprenticeship in every field of labor, I doubt if coming generations will show as many such examples. The time required for attending to practice, perfecting technique, doing research work, and keeping pace with the literature will overwhelm him who does not start with one purpose and one work.

The general practitioner who after some years of practice suddenly undertakes to do his own major surgery may occasionally succeed in becoming a safe surgeon, but this will be very rare. This type of operator is usually dangerous to his friends and patients.

It must be admitted that at present surgery may be done by anyone legalized to practice medicine and surgery by the state. This work is undertaken by those not qualified to do major surgery, by those who are capable and safe in all but complicated, unusual, and serious afflictions, and by trained surgeons.

The factors tending to bring about the undertaking of major surgery by those who are unqualified are:

1. The pupil often unfitted by lack of education or temperament to enter upon the study or practice of any branch of medicine

2. The poorly equipped medical school

3. Unqualified teachers who often, through the ownership of stock or through social or professional influence, hold positions others could better fill. Such teachers are not liable to exert the best and most refining influence over pupils. This type is rapidly passing.

4. The division of responsibility for surgical instruction, the resultant limited material, and short period clinics

5. The degree of M. D., and the passing of a state board examination in writing without showing any special ability to do surgery

6. The belief of the new graduate who has not had a surgical training that all surgeons have had to begin some time, and that they must do likewise. Untutored, they proceed as opportunity offers itself.

7. The inability of the inexperienced to overlook the commercial side upon seeing a large return they shrink from referring that patient to another.

8. The failure of the patient or those responsible for him to differentiate between the trained and untrained man. How can they? There are no marks to distinguish them at present.

9. Last, and most important, is that complex problem, the open hospital. Much of the advancement in surgery has been made possible by the existence of the modern hospital, which has afforded us a safe workshop in which we have been able to demonstrate operative possibilities.

Not one of us is ungrateful to those who have given liberally of their time and money toward the development of these institutions. Many of our hospitals are managed in a magnificent manner, but more are not. It is not the hospitals above criticism, but those below standard, to which I wish to pay my respects. I feel that the latter are more or less harmful factors in the development of surgeons and the practice of safe surgery, by reason of their encouragement of the patronage of operators of the poorer class, often indiscretion in the choice of staff men, poor nursing, and inefficient management. Public criticism has rarely been directed toward them because staff men, if they became active critics, were subject to the loss of staff positions, and always looked forward to improvement in conditions, while the public viewed the institution from without with an eye of admiration and deep reverence, it assumed that because it was a hospital, all within was perfect. It was not difficult to educate the public to the proper care of garbage which once was allowed to fill their alleys, and less difficult to teach them the danger of the sting of the mosquito or the dirt of the fly's foot, but in each instance general supervisors were behind the movement, to educate on the one hand and to enforce the law on the other. I believe we will have to come to the same in general supervision of hospitals through state control. Such a supervision is justified in Illinois, where funds may be withdrawn from circulation by public subscription and through bequests to the benefit of corporate bodies, which in turn, because of existing conditions, charge unnatural prices for private service, those extending a certain amount of charity are exempted from taxation and liability for personal injury. All hospitals strive to serve the state's sick, therefore the state is justified in seeing that its sick are well cared for. You may give us medical men of the highest calibre, but they cannot extend the most efficient service unless the workshop is supplied with proper tools well kept, the help up to standard, laboratories complete and competently presided over, and the general management all that it should be.

In the first place, I believe great sums of money could be saved to the cause of the sick if there were some additional legal control of hospital construction. As I have gone about the country the last fifteen years in a professional capacity, I have marveled at the indiscretions practiced in hospital construction. Often plans have been drawn by mere laymen or contractors or by architects not familiar with hospital construction or requirements, and often medical advice has been ignored. The site has been improper, grounds too limited for growth, light and ventilation defective, and no provision made for special requirements of that locality, or too little space given to housing patients has resulted in poverty and the closing of hospitals which might have served their locality well. Others have been abandoned or sold at a loss because of lack of forethought in erection. A state adviser in all these matters would prove very helpful, tending to harmonize local factions and to direct the attention of boards to future utility and to economy, so that many a period of hardship would be averted.

In Chicago we are seeing the installation of able, trained men and women as superintendents of our better institutions. The day has passed for the untrained Sister or Brother Superior or the widow or down-and-out man to reign supreme in our hospitals, where so much intelligence and caution must be exercised in so many and varied departments. When husband, wife, or child is placed in one of these institutions, those at home have a right to expect that the hospital to which they are entrusted be well managed. Whose business is it to see to this? Whose business is it to see that a hospital superintendent is qualified to oversee all of those entrusted to the hospital? Who asks where the milk supply comes from? How is it kept? If the dishes and bed-vessels are sterilized before being handed from one sick room to another? If the superintendent knows what infections to exclude from the hospital, or how and for what to establish and maintain quarantine? If our operating rooms are unsafe, to whom may we report that after the management has failed to correct the defects? If the help is unskilled or equipment defective, who may pass upon that after the local management has failed to act? All these delinquencies have been encountered, and tend to discourage surgeons, who must be exacting because of the nature of their work.

For years one hospital of this city purchased milk of such poor quality, seemingly containing preservatives, that, as fond as I am of milk, I could never drink what was offered me there. Yet this unfit food was the only food of many patients.

One hospital refused to purchase instruments or to keep those on hand in good repair, because they were said to be misused or would disappear. Those who wanted a respectable equipment had to bring their own. Yet what could have happened had special emergencies come in? Every hospital, whether inviting emergency work or not, should be required to have a specified equipment kept in proper repair.

After doing certain delicate plastic surgery on an aged woman, who should not have been exposed to the dangers incident to another operation, I specifically directed the Superior of a new and growing hospital that a graduate nurse must be put in charge, and if she could not secure one to notify my office. She expressed great willingness, but the next day I found instead a young woman who had been in training three days, the purpose of the operation was defeated, and henceforth I was unable to get an audience with the lady in authority. Such expressions of

ignorance on the part of those in authority is exactly what I mean to direct attention to, and I think the time has come when others will have less hesitancy in doing likewise, which will result in some care being taken about who is put in charge of hospitals. This care will be increased if the state effaces that law exempting charitable institutions from liability.

In order that internal conditions may be brought to the highest standard of proficiency, and ultimately a reduction in institutional cost to the sick, now exorbitant, I would advocate that all charity institutions also caring for pay patients be required to spend their net earnings, inherited and subscribed funds, or the proceeds of either, in or upon their own institution, instead of being disbursed in the development of sister institutions at other points. I can point out to you unfit operating rooms in this city which would not have become so had a state inspector made irregular rounds throughout the year.

It must not be understood that some supervision is not had of hospitals in this city. It consists of regulation of floor and air space, sanitation, keeping of records, and elevator and fire inspection. The state now has no direct supervision of hospitals.

The hospital may further influence the doing of surgery through the conduct of its nurses' training school. After several efforts before the legislature of this state, a State Board of Registration of Nurses became legalized, whose duty it is to examine and register graduates. Upon canvassing the situation, only eight schools of about fifty then examined in Illinois were considered up to the board's standard of requirements. This was because of inadequate courses of study or a deficiency of work, often limited in variety.

It has been stated that it takes time for training schools to arrive at a point where they can command proper talent as pupils and teachers and do proficient work. In reply I can only say it depends upon who is behind the gun. The Nurses' Training School at the Children's Memorial Hospital, then only two years old, was in advance of the State Board requirement when the first state-wide inspection was made, and then and now stands in the fore-rank among schools of the state. It does so because those behind it have sought far and wide, determined to secure the best and most talented teachers available, pay them fitting salaries, and set the standard of admission high, they are serious and systematic about matters of practical and didactic instruction, and provide fitting quarters and refining influences for their pupils.

We must have the best quality of nurses obtainable and must do all we can to make the work more attractive to a high grade of womanhood, that our patients may obtain the most intelligent care in the hospital and at home. Nursing was at one time the most inviting field to sensible, self-respecting, and well-educated young women, but not as many of this fine type are entering the field as should. Complaint is justly made that hospitals cannot secure enough applicants with proper educational and other qualifications, yet some of the better training schools seem well supplied. Hospitals have no one to blame for this deficiency but themselves. The reason may be seen in their miserable dining-rooms, with worse dining-room service, the dormitory quarters with lack of privacy, absence of comfort and home-like surroundings, long hours without considerate regulation, poor if any rest-rooms or gathering places, and the unpedagogic management of courses of instruction. The atmosphere has often been too clouded with the spirit of getting three years' work out of young women at the least cost, rather than that of doing a great uplift and educational work. We may expect much good to come from indirect state regulation already in force.

Will hospital managements ever learn that at the operating table, serving as first table nurse, where all is exactness in cleanliness and procedure, is no place to train nurses? We must insist that everyone in general charge of the operating room suite, the one serving as first nurse at the instrument table, those in charge of floors containing patients, and the training school superintendent, show competency before being allowed to assume that duty. The nurse in training who serves at the operating table retards every operation, increasing the risk to the patient through longer anesthesia and unnecessarily long exposure of wounds. Her asepsis is rarely good, and by the time she has learned to assist speedily and carry out good aseptic technique she is transferred. The untrained floor superintendent neither instructs pupils nor supervises well, yet orders are all entrusted to her; while the inferior training school superintendent is responsible for poor organization and poor nursing throughout the hospital.

By their staff appointments hospitals may further influence the development of surgery. The more sectarian, the more liable they are to be inclined toward arbitrarism and sectarianism. Happily this is not altogether true, for they cheerfully appoint to membership those who assure a large patronage. These are not places for the inexperienced or those who can never arrive.

Such appointments should never be given to anyone who has not qualified, for that very appointment places institutional and perhaps fallacious professional approval on the appointee. Public welfare will be best conserved if such appointments are left to the profession, and the number of appointees limited to the actual requirements of the hospital. The first object should be good and safe service to the sick; the next, recognition of men who have prepared and made good. This condition of affairs will prevail when the state takes a hand in these appointments through civil service or through joint control, requiring exhibition of proficiency before any appointment is made. Until then, each of us should be careful to influence only the appointments of trained men, and not the aspiring novice.

A few years ago a staff newly organized showed a list of regulars, associates, and consultants numbering about forty. There were about one hundred beds in the house. I strongly advocate a compact staff, with a view of centralizing responsibility and promoting better organization, therefore greater proficiency. The village hospital or that of a small city should not strive to make a surgeon of every member of the profession in the town, nor should every board member seek to place his favored physician on the staff. The old system of appointment at Cook County Hospital through influence resulted in many surgical jokes, which were no jokes at all to the patients.

Nor do I believe in the system of appointing non-active members to hospital staffs. The attachment of such names is misleading to the public, the hospital bearing the reputation of being attended by men who do not attend, and an empty honor is bestowed for which no service is rendered. It often removes active control from the hands of active men who should be in control, because they know local conditions and requirements, and it is their demands that are to be met, and they justify this control because of their labor and the income they provide the hospital. Methods of hospital organization in non-teaching private institutions should be uniform and appointments equitable. The chief should prevail only in teaching institutions or those in which there is a reasonable prospect of the introduction of medical teaching. Even the Massachusetts General has given up the appointment of a chief. In a democratic country, at least in the way our local hospitals are run, the chief does not direct assignments, nor can he influence the manner of doing private work which constitutes the majority of that done.

The most flagrant sin in which hospitals may

co-operate is "the open door," first prompted through generosity and a thorough desire to extend the usefulness of the plant to all the profession; later assuming the attitude of competition, inviting everyone who wishes to do surgery. This would be very generous and show a fine spirit, as first intended, if all who attempted major surgery were qualified to do it. Many of us can recite observations which would in themselves arouse such indignation as to invite laws without further solicitation on our parts.

It is in the open hospital that one sees or hears of the one to two-hour appendectomy, the four-hour hysterectomy, the one-hour dilatation of the cervix uteri with uterine curettage, and of occasions where the operator is lost in the field, and the interne completes the operation for him.

I would not advocate the exclusion of men who are not surgeons but who operate safely and intelligently, but I would advocate a policy on the part of hospitals of refusing to take patients to be operated upon by those who do notoriously poor and unintelligent work with a high mortality. I would further advocate state supervision and scrutiny of all hospital statistics, and where mortalities rise higher than the average, find the reason why, and if they continued abnormal close the hospital. This would bring about exclusion of those who should not operate. The work would rarely be undertaken at home, because such operators would not thus have the moral support afforded by doing their work in a hospital.

You of maturer years must not tell us that these revisions are up to the individual worker. Your work goes smoothly on, so may mine; but our combined work is only a small fraction of what is done throughout the state. Many of the workers have far from perfect environments and conditions and must make the best of them, just as you and I have had to do until our position or the volume of our work commanded more consideration. It is only by legal regulation of the hospitals that we may expect prompt and general revision of defects, thus providing greater satisfaction to all those engaged in doing surgery and greater safety to those entrusted to them.

I suggest that our body, through a committee of its members, strive to have laws enacted which will have to do with the distinguishing of those who have qualified to do major surgery from those who have not, and laws regulating institutions caring for the sick, thus making such matters the state's business instead of that of the individual.

I believe that more systematic and thorough teaching of surgery and requirements additional to those necessary to obtain the degree of M. D. should be given by medical schools to those wishing to practice surgery, an added year or a required interne or assistantship, or both, are worthy of consideration.

I further believe that every man who will have qualified to do surgery will welcome special demands by the school or state, and that every good hospital will consider state inspection and regulation an uplift.

## DISCUSSION

DR. GEORGE W. WEBSTER, president of the Illinois State Board of Health, was asked to open the discussion. He said: It is axiomatic that good health, with length of years, is the greatest asset of the people of the state. Any plan or method which has for its end that of elevating and improving the standard of medical education in the state must be for the betterment of, and must result to the advantage of, the people of the state, and therefore should receive our commendation, our encouragement, and our support. All pioneer work meets with opposition. That is notoriously true when that pioneer work concerns education, whether it be special professional education or any other kind of education. In our own state there are those present who remember the fight that was made in our legislature in order that we might have high schools. We

now regard high schools as a necessity. In the same way there was the same kind of fight, the same kind of opposition, to the establishment of normal schools for the training of teachers to teach in our high schools. Now we regard these schools as absolutely essential and fundamental in our educational system.

In this plan which is proposed it seems to me that there are many elements of good, and yet some difficulties in the way. If we are to have a degree in surgery, one that is to mean something to the people of this country and to the people of the world, that degree should be wider than the boundaries of a state. It should be nation-wide in its character. If it is to be nation-wide in its character then it must be an educational requirement or degree, and not a legal one, the reason being that under our Constitution all

the powers that are not specifically given to the federal government, and not denied by that instrument to the states, must reside in the states. The license and control of the practice of medicine is not given by the Constitution to the federal government, but resides in the state, and comes under what is known as police power. To have a degree in surgery that would be national in character would require, first, an amendment to the Constitution of the United States, second, an amendment probably to every state constitution in the Union, and third, an amendment to the medical practice acts of all states. So it would seem to me that, if we are to establish a surgical degree that is really of high character and that will commend itself to the respect of the people at home, as well as to the surgeons abroad, it must be an educational requirement rather than a legal requirement, because if it be legal, and therefore a state requirement, it again will vary very widely, just as a medical degree varies in its character in one state as compared with another. A surgical degree that might be conferred in the state of Illinois might differ very widely from a surgical degree that was granted, we will say, in Texas or South Carolina or Mississippi. If it is to be broad and comprehensive it ought to be of national character.

It seems to me, however, it is a step in the right direction. It is something that probably is bound to come, and yet, while we are thinking of this, we must think not merely of surgery but of the whole field of medicine. You men doing the surgery of the city of Chicago only think in surgical terms, and yet we must be broader than mere surgeons and must bear in mind the criticisms that have been offered to-night on the character of surgery that is done in the small hospitals. In the small cities outside of Chicago, or anywhere else in the state, it is fully equal to the work that is done in obstetrics, and the work that is done in obstetrics is probably fully as high in grade as the work that is done in diseases of the eye and ear, or in rhinology, or laryngology, or, for that matter, in the practice of medicine itself. So that if there is room for improvement in the surgical degree, there is also possible room for improvement all along the line.

In regard to the question of licensing hospitals, it seems to me that is a very valuable point in the paper of Dr. Buford, and it is true, as he says, that the state exercises no supervision or control over the hospitals in its borders. That is largely because of the fact that the state law

says specifically that a village, a town, a city incorporated under the laws of the state of Illinois, shall have power and authority to do all acts and make all rules and regulations that may be necessary or expedient in the interest of public health. Those are the words of the statute. In other words, our Constitution and our plan of government favor local self-government, local option, and each community is left entirely free to manage its own public health affairs as it sees fit, so that there is that difficulty in the way of the states managing or controlling or supervising or licensing hospitals. In the city of Chicago, for instance, the department of health has control over the matter of licensing and supervising hospitals, and these hospitals are required to make reports to the department of health, and the department supervises and regulates these hospitals. The smallest city or village or town in the state of Illinois, as incorporated under the Constitution of 1870, has just as much authority and power to regulate its own affairs in regard to its hospitals or anything else as the city of Chicago. But I want to be recorded as heartily in favor of anything of this character that seems to be a movement in the interest of higher and of better medical education in the state of Illinois and in our whole country.

I wish to thank you for the privilege and pleasure of being with you.

DR A. J. OCHSNER: I have always had very definite ideas about the qualifications of surgeons, and I am very glad this subject has been brought before us, and also that the Chicago Surgical Society is to have a committee which will carefully study the subject, because it will require an endless amount of study before rules can be formulated which will be worth much.

You know, of course, that there are two very distinct systems—the German system and the English system of qualifying surgeons. In England a person is not looked upon by the community as a qualified surgeon unless he be a Fellow of the Royal College of Surgeons, or unless he has the right to print on his card F. R. C. S., and that right he receives by performing certain duties and passing certain examinations, and by having performed certain services which are recognized by the Royal College of Surgeons as entitling him to the position of fellowship. Every licentiate, however, is permitted to do surgery if the community desires him to do it, and the F. R. C. S. title but places him in the position in which the community knows that

competent persons have considered him competent to do surgery.

In Germany we have entirely different conditions. There the community knows that a man who has been an assistant in this or that clinic comes out as a competent surgeon. If he has not a clinic behind him, the community does not look upon him as competent. In neither case is there an element of licensing such as has been spoken of to-night.

When we look back to the time when many of us came to Chicago—as, for instance, the time when I came here—when we had Moses Gunn, Charles T. Parkes, Christian Fenger, as the great surgeons, not one of these men had ever been an interne. Christian Fenger had been an assistant in a pathological laboratory, but neither of the other two great surgeons had even had an internship. And still, compared with the men we have in Chicago now, these men were giants. They were great surgeons. They were thoroughly competent compared with conditions now. You take the greatest surgeons of this country to-day—Charles and William Mayo—and neither of them has ever had an internship in any hospital. When you come to make specific requirements for licensing these facts will come out, and it will be a difficult matter to make it clear to the legislature, for instance, why we should have laws now which would have excluded these men had they been in effect in the days when they entered the practice of surgery. To have had such laws would possibly have eliminated the greatest men in those days from the right of being licensed as surgeons. We must, however, bear in mind that the conditions are entirely different from what they were then, and that the qualifications ten years from now will be entirely different from the qualifications which should obtain to-day.

The reason why every German surgeon, no matter where you see him, is a good surgeon, a competent, high-class surgeon, is because every one of them has gone through a certain course of assistantship, in which he has come in contact with an endless amount of practical work that naturally would make a good workman of him. The reason why there are so many excellent surgeons in this country is because these men who have become excellent surgeons have had to fight conditions. They have had to make conditions. They have had to work against conditions. They have had to take things as they were, and, with an endless amount of energy and an endless amount of labor, and with no regard for their personal comfort, they

have worked out of these difficulties and have become really first-class surgeons. Now, with these extremely complicated conditions, I believe that, if we should jump at some conclusion and try to work out this year, or this month, or within a few months, a reasonable system, we would fail. On the other hand, if we go at it from the bottom up, work it out, work out the conditions just as the Council on Medical Education has done in the American Medical Association, in taking the conditions as we find them and putting them together, and not trying to establish conditions such as we think we should have, but rather such as we find that we can have with our surroundings,—then I believe we will do something that will be worth while.

One of the most important elements in the production of competent surgeons must be attention to our own assistants. Those of us who have the good fortune of having hospital appointments in which we can do things can give a great amount of attention to our assistants. In other words, plan our work so that after an assistant has been with us for one or two or three or four years, he has had opportunity provided for developing into a good surgeon. That, of course, does not mean that the road has been easy for him, but that we have put an endless amount of labor on him, and made him pick out or dig out his possibilities. In thinking over this question since it was suggested at our annual meeting, I have called to mind the men in this country whom I would be willing to class as surgeons that would be good enough to operate on me or a member of my family. Of these, there is a very large proportion of men who have had a class of surgical training which I would not consider proper to entitle them to a fellowship in a national surgical college like the Royal College in England. Still, these men have become infinitely better surgeons than some of the men who have had most excellent educational opportunities—some of the men, for instance, in the older cities, such as New York, Boston, and Philadelphia. I believe this committee will have a large amount of very responsible, interesting, and profitable work to do.

DR. M. L. HARRIS: For many years the elevation of the standard of medical education has been a subject of discussion in the medical profession. The chief object in organizing the American Medical Association was to elevate the standard of medical education. That this should be a subject for discussion in the profession is perfectly evident when we stop to think that only the profession itself is capable of judging what



is good and what is bad medical care or treatment. It is a fact that people, as a rule, are incapable of judging what is good and what is bad in medical treatment.

We know that it is necessary to improve the standard of medical education, and during the past few years much has been accomplished in that line by systematic work. Previous to that time the American Medical Association attempted to elevate the practice of medicine, but it did it by passing resolutions, and we know what kind of paving stones resolutions make. It was not until we paved with money that we got any results. When we spent money we got results, and we have done more in the past five years with the money we have spent to elevate the standard of medical education than was done in sixty years previously. We have improved the conditions in the medical school, but we must remember a medical school is simply a place for teaching a few facts to an individual. Any normal individual can be taught some facts if they are hammered into him long enough and hard enough. But we seem to forget that teaching them facts is not making a doctor. Becoming acquainted with facts is knowledge, but there is something beyond that. Knowledge is absolutely worthless in the practice of medicine unless that knowledge is ruled by good judgment, and we forget that judgment is an individual quality that rests with the individual himself, and that no power outside of that individual can ever give it to him. Of course, we can bring up the facts to him. We can teach him what Fact 1 is, what Fact 2 is, etc., but what he has got to do is to determine what will be the sequence—in other words, what is the inevitable dependence of these facts when they coexist in the individual. That is judgment, and that is wisdom, and you cannot teach it. It is part of the individual himself.

Dr. Ochsner has told us about these great men and said they did not have these advantages. That is true. It is true in every line of life. We have great men. Can we lay down rules for them? Why, no. They are above ordinary rules. These men are not great surgeons because they had great teaching. Dr. Ochsner says they overcame obstacles. How did they do it, and why? Because it was in them. It would not have made any difference whether they were surgeons or something else, there was something in them that makes good judgment, and they developed along the line of surgeons. Who would think of laying down rules to govern Billroth? He overruled everything. But

such men are the great exceptions. They seem to show what good material can make of an individual.

Now, when a physician gets out and begins the practice of medicine, he is loaded up with a lot of facts, but he has little or no judgment. It takes time and experience to develop good judgment. If one's judgment is wrong, and somebody shows him it is wrong, the next time he will work out another conclusion. But he has to work it out himself. This does not apply to the surgeon any more than it does to the physician or the specialist in any department. Some people never have good judgment; and it would make no difference if they were to practice medicine for a hundred years.

All of our statute books are overrun with medical laws that are not worth a continental. I believe every medical practice act in the United States is fundamentally wrong in principle. In making that statement it is not a snap judgment, because I have been over the medical practice acts in every state in the Union, and I know what these acts are. They do not help the people because, there is not a single medical practice act in the United States that is put in force and lived up to—absolutely not one.

The present method of licensing a physician or surgeon, I believe, is absolutely fundamentally wrong in principle. There is no way of getting good surgeons and good physicians until the people know what a good physician and a good surgeon is, and when they know, and ask, and demand good surgeons and good physicians, then they will get them and they will never get them until they do. My idea is not to license anyone to practice medicine. I would let anybody practice medicine that wanted to and could get the opportunity. I would not care whether he had been in school in his life or not, provided he had the necessary knowledge. Any sane adult individual has the inalienable right to get anybody to treat him that he wants to, and no one has a right to say he cannot do it so long as he harms no one else by so doing. What I should do if I could, would be to have a high educational standard, and have a high-class board independent of every outside influence, and I should have that board pass on the educational qualifications of the individual who desired to practice medicine. If that individual had an education up to the standard set by that board, then the board should be able to stamp him as one qualified to practice medicine, and he should be permitted to let the public know that he had these qualifications. It

makes no difference whether it be medicine or surgery, the principle is just the same. I should also have it so that no person who had not the approval of this board should be permitted to go before the people as a qualified physician, and it should be so simple, so easy, that no person, however ignorant, could fail to get a qualified man as a doctor if he wanted one, and if he did not want one, he should have a perfect right to get any other man he wanted. However the criminal code should distinctly provide that any unqualified person who attempted to treat the sick in any manner whatsoever, and who thereby subjected others to harm, as for instance contagion, etc., should be held criminally liable. The liability should also extend to those who deliberately provided unqualified persons to treat sick minors or other dependent charges, and there are many other restrictions, which need not be mentioned at this time.

Again, I do not think anyone should be a surgeon who is not a physician. I do not think any man should practice surgery or any other specialty who has not practiced medicine a certain number of years. There is no part of the body which is independent of the whole.

Under the present medical practice acts it is practically impossible to convict a quack in any state in the Union. What does it mean? The law? No. You can write almost anything on the subject on the statute books, but the people do as they please. You cannot get any law enforced which is above the sentiment of the people. It all comes back to educating the people. When you educate the people as to what constitutes a good physician or a good surgeon, they will have them, but until then, they will have anybody they want.

DR. JACOB FRANK: The subject to-night is whether a surgeon shall be recognized as such or not. I am fully in accord with the papers as read this evening, and I am glad that the Chicago Surgical Society has taken the stand it has. Some of the members present will recollect that two years ago, in my closing remarks to the Society, I brought this subject before them. Therefore it is not new to me. I have given it a great deal of thought. At that time I stated (the article was published in *SURGERY, GYNÆCOLOGY AND OBSTETRICS*) that the old master surgeons had to work hard and faithfully to get the confidence of the people and to bring surgery to the important place it now occupies, and that it remains for us to retain that confidence and see that we keep up the standard of the surgeon.

Asepsis and antiseptics have made the inexperienced young surgeon bold and reckless.

With all due respect to Dr. Oschner, with all due respect to Dr. Mayo, and to other men who have hospitals in which no other surgeons do work, they are not the ones to judge what is going on in Chicago to-day. It is these open hospitals that allow young men to do surgery who never had any training, who have never had an internship, who have only seen such masters as Dr. Oschner and others at work, that I complain about. The surgeons I have mentioned, and others, do their work so easily that these young men, in watching them, think that they can do the same thing; and when they get a patient to operate upon they have him or her, as the case may be, taken to some hospital, and, as some one has remarked here, they commence the operation and then get the internes to finish it for them. This is not a question of to-day. It is a question of the future.

If we cannot legislate, if we cannot change the Constitution of the United States, if we cannot make laws in the state to protect the people against mediocre surgeons, then it remains for the surgeons in the city of Chicago, as a duty, to educate the people as to what constitutes a good surgeon. All advancement, all great movements take root, not in the general welfare, but locally. Christianity did not commence at once all over the world. It commenced in an insignificant country that to-day is not recognized; but how did it advance? It has advanced as all movements for welfare advance, slowly but surely. If we can educate the people in Chicago, and show that it is a success, then other cities will take up this matter and do the same thing.

One word with reference to hospitals—I could talk all night upon this subject. I believe I was the first to advance the idea of standardizing hospitals, in an address which I delivered before the Mississippi Valley Medical Association in welcoming the members of that body to this city, and which no doubt will be published in the official organ of that organization, namely the *Lancet-Clinic*. The hospitals are to blame for the poor surgery and for the bad work that is done in them. There are hospitals in this city that allow any man to go in there to operate. They know that this or that man cannot operate; they talk about their operating, but they take them in and allow them to operate on patients to get the room money. I say, any hospital that will take any patient, or a doctor that will send a patient to a hospital, telling the patient that he or she will receive better care than they

would at home, they are taking their money under false pretenses and ought to be liable for damage suits. If we cannot make legislation for surgeons, then we cannot make legislation for hospitals. I believe we can make legislation for hospitals which will require them to give the people what they promise, and we know that there are hospitals here in which you cannot get the right kind of laboratory work done. There are some hospitals here who, when they find a man does not do good work, will invite him to stay away and this ought to be done with all hospitals. I hope that the movement that has commenced in Chicago will continue, and if we cannot make a national affair out of it, let us make of it a local affair, and let us make it successful. If it is successful in Chicago, I am sure other cities will follow.

DR. CARL BECK: "Times change and we change with the times" is a Latin saying, and I think it may be very well applied to all reforms. Twenty-five years ago a discussion of this same subject took place in Vienna. In Austria there was no internship except assistantship, and in the very well equipped and well governed hospitals of Austria there were men like Billroth, Gussenbauer, and others of equal fame as surgeons. Outside of these men and their assistants there were no trained physicians or surgeons. Then the question arose as to what should be done with the young men graduates. Should they be "let loose," as Billroth said, upon the public without any practical knowledge, or should there be a law that every man desiring to practice medicine should be obliged to spend at least one year as an interne in a hospital? This internship could not be extended to all students or to all doctors, but the opportunity was afforded to a large majority of them, and to-day very few men practice surgery in that country unless they have been either assistants or "secondaries" for a number of years—not merely one or two years, but for a number of years. These conditions are deeply rooted in that country. Everything is law. Every step is law. Everything that is forbidden is so stated on a black-board, and you can see the word "forbidden" posted everywhere. The public of that country has been educated up to that point.

In this country it is freedom that has made the surgeon. I cannot refute the remarks of Dr. Harris. I think myself, having grown to manhood across the water and in that restricted field, that freedom has made the surgeons of America the ideal surgeons of the world. Whenever the subject is brought up abroad the foreign-

ers always point to you, the American surgeon, as the surgeon of to-day; and personally I would trust myself to a hundred American surgeons if I were to be operated upon, while I would be exceedingly careful as to placing myself into the hands of as many Europeans. The freedom we enjoy in America makes the surgeon; but in our day that freedom is misunderstood by many, and hence every opportunity to operate is taken advantage of by men who are not competent to operate. Patients are being operated on by tyros and by men who have never had any surgical training. We have a great many men who are what we call average surgeons. Of course there are certain geniuses, like the Mayos, who do not need an internship. Either one of the Mayo brothers would have been a teacher and surgeon without having received training under masters, although they have witnessed the work of a number of the great surgeons of this country and abroad. Raphael would have been an artist even if born without arms. Dr. William Mayo has traveled about with Dr. Ochsner very extensively, and they have both stood at the operating tables of some of the greatest surgeons of the world, and no doubt both have profited by this training and observation. There is no one man or surgeon who has a monopoly of things, and almost every surgeon can teach another surgeon certain things that the latter does not know or perhaps an easier way of doing a certain operation. But for the majority, for the average man, there must be training—not of one year, but of many years, and some such system as they have in France or in Germany should be advocated, and the public, first of all, should be educated to recognize those who are entitled to do surgical work, and particularly major surgical work. There are many so-called surgeons who do bungling surgical work in hospitals in consequence of lack of training. Of course, all of us have done some poor work in the early part of our careers. We must all acquire experience, but most of us have acquired our experience by assisting a master for years, experimenting on cadavers and on animals only—not upon patients, as would be the case if surgery were practiced without an assistantship having been served. I therefore agree with Dr. Frank that every man who desires to do surgical work should be trained for it.

DR. D. W. GRAHAM was asked to continue the discussion. He said, I agree with much that has been said, and disagree with some of the speakers in many respects. There is one

remedy which I think will correct this evil to a very great extent, and that is to let the surgeons reduce their fees one half or three quarters. When we do that, the temptation of an incompetent man to operate on major cases will disappear, and he will not do it. When we get down to the root of the matter we will find it is largely the money question. I do not know that I would be the first one to climb down, but the suggestion must be considered if we would account for the evils complained of.

Another point: Bad as the situation is, is it any worse in surgery than in any other department of medicine? You have heard the experiences related by Dr Harris, and I am sure all of us could tell similar stories. We see the most ignorant kind of prescribing, the most ignorant kind of management of patients, the woeful lack of qualifications in therapeutics, and in diagnostics as well. There is as much complaint about bad obstetrics as about bad surgery. And so in every operative department of medicine. What does this point to? For one thing, that the standard of qualification should be raised all along the line. I believe some kind of a plan can be worked out for a voluntary organization such as has been spoken of which would have a good moral influence on the community and the profession. But it should be remembered that many men could get into such an institution by reason of their scientific attainments who would yet be bunglers in any operative field. I do not believe we can ever get a legal standard for any specialty in medicine, and I hardly think we should have.

DR. WILLIAM M. HARSHA: It seems evident from the papers and from the discussion that there is something wrong, and it does not seem clear how it can be remedied. I agree with Dr. Graham, that the need of the practitioner for business is one of the causes why he attempts surgery. When I came to Chicago twenty years or more ago the Chicago River ran the other way, and one could not catch fish within two miles of the river, but he could catch typhoid fever any place in town. All of the doctors seemingly were busy in treating diphtheria and typhoid fever. Now, with the anti-tuberculosis crusade, the fresh-air fad, and the daily education of the people by the papers, health bulletins, and giving them a general all-round education, the income of the average practitioner has been materially cut down, and with the activities on the part of the state board of health, other diseases have been eliminated. All of these things have tended to reduce the amount of

work that is done by the practitioner, and so he is looking out for other fields—and he is going to do surgery. It will be impossible, in my judgment, to get legislation to regulate this matter until public sentiment is educated, and that takes a long time. I do not believe Chicago has any patent on this particular uplift movement. Two years ago or more the late Maurice H. Richardson had a splendid article in the *Annals of Surgery* on this subject, namely, "The Training of Surgeons"—meaning, of course, special training and the need for it. I believe, too, as Dr. Webster has pointed out, that this ought to be a nation-wide movement. The sooner it can be agitated by the American Medical Association in its organ, the sooner it can be made a nation-wide subject, the sooner we will get a unified expression from the medical profession, and the sooner we will get legislation, if we ever can; but before we get legislation we can create an interest in the minds of the people in this movement that will do much to aid this cause.

The standardization of hospitals can be brought about through various associations in various states. I think what Dr. Frank has said is very important. I believe every hospital will strive to meet the requirements that will be made of it by a commission that is properly authorized and organized—one that will extend all over the country.

DR. C. C. ROGERS: I have enjoyed these papers very much, but I have not heard any legitimate way of remedying the evil. I believe exposure or publicity is the best way to help to remedy any evil, whether a person belongs to a certain society or not. No one should be exempt. I believe that if every patient who died within a certain time following a surgical operation was a coroner's case, and the coroner was at liberty at any time to open the abdomen and examine the patient and see the exact cause of death, putting the cause as found on the death certificate, it might make some of the members of this society blush to see the report on the death certificate, no matter how long the surgeon has been doing surgery or how old or experienced he may have been. I believe that would be the best way to educate the public to distinguish between a good surgeon and a poor one. For I believe the relatives and friends have a right to know the cause of death. Not only that, when we operate let us observe what is removed from the patient, and let us compare what is removed from the patient at the time of the operation with the condition of the patient when

death occurs, and find out whether the pathology was sufficient to cause death or whether the surgeon himself caused the death. I believe that is the way to get at it. You cannot make a surgeon out of a man by having him witness a few operations. You may put a man in a hospital and give him 18 months' hospital training, put him under a good surgeon, and have him assist the surgeon for 25 years, and he may not be able to do an operation as it should be done when he gets out.

DR. D. W. GRAHAM: I would like to ask Dr. Rogers how he would get the coroner's office trained to pass correct judgment on these things.

It takes a good physician to do that, and the average physician in a coroner's office cannot tell what a patient dies of, by any means, even when he has the advantage of a full clinical history, which he does not often have.

DR. ROGERS: I can answer that. I believe we can get physicians who are not grafters to act as coroner's physicians, just as well as we can have a society called the Chicago Surgical Society and that society can determine whether I am fit to do surgery or not.

DR. COLEMAN G. BUFORD (closing the discussion on his part). In taking up this matter and the work in connection with it, I think it ought to be restricted to the state. There is no use in trying to influence the entire country all at once. No doubt our position will be sustained, and other states will follow our example.

With reference to the matter of some good surgeons having received no early training through interne or assistantships, I will say that although my acquaintance has been large, I have not had as extensive an acquaintance among the good surgeons throughout the country as Dr. Ochsner. Among those I have known I do not remember one whose attainments did not date back to a good training of one form or another. I have seen instances where men have been forced into doing surgical work, either by growing up with it or by surgical training of some kind being unexpectedly brought to their door.

Dr. Fenger told me he had served as amanuensis in an eye and ear hospital and under Meyer in a nose and throat clinic for some time. I am also under the impression that Fenger served in a hospital as interne. [Reference to Fenger's autobiography shows that he served as amanuensis in Vilhelm Meyer's clinic and in his private practice, and that he served a two-year interne-ship in the Roy Frederick Hospital in Copenhagen beginning in 1869.] Fenger was drawn into

surgery in a good many ways. He was with the Danish army as assistant ambulance surgeon through the Schleswig-Holstein war. He went back to school, graduated, and then went to the Franco-Prussian war, serving as ambulance surgeon, so that before he got back into pathology he was a trained surgeon.

DR. GEORGE W. WEBSTER: I would like to say a word in regard to one remark made by Dr. Harris. I understood Dr. Harris to say that law has had nothing to do with the advancement of medical education or the raising of medical educational standards in this state or in this country. That statement, it seems to me, needs no answer, yet I would like to inquire what it was that drove 1500 men out of the practice of medicine in the state of Illinois in one day. It was the enforcement of the medical practice act of 1877 in this state. I would like to inquire what it was that has raised the standard of medical education in this country from the standard of '76, when that standard was such that any man, without any preliminary education, without any medical education whatsoever (a standard which Dr. Harris favors), could go out and announce himself as a practitioner of medicine and have a right to practice medicine in the state of Illinois. The answer is, the law. The law is what has raised the standard of medical education in this country, and the law has been in advance of the sentiments of the majority of the medical profession of this state and in this country. Gentlemen, in medicine and in everything else, in this country and in every other, a few men have had to do the thinking for the many, and it will continue so until the end of time.

In regard to the question of whether it is right and fair and proper that anyone shall practice medicine, and that everyone has a right to employ whomsoever he chooses to treat him, let us take a concrete example. Here is a case of diphtheria in an apartment house, and here across the hall is a family of children. Suppose the person who is permitted to attend that child with diphtheria is an uneducated person who knows nothing of the care of contagious disease and cares nothing for the rights of the community, and such a person comes in and does not care for the child and does not care for the community. I want to point out to Dr. Harris that in our Constitution—and we all live, thank God, under the Constitution—it is provided that every citizen has the right to life, liberty, and the pursuit of happiness, and that no person has a right under our Constitution, where they have

a sick child, to employ an uneducated, unqualified person who does not take into consideration the rights of the people who are well; and the people who are well are the ones who have certain rights under our Constitution. We do not maintain smallpox hospitals primarily for the purpose of curing smallpox, but for the purpose of protecting the people who are well and who have a right to protection under our Constitution. Gentlemen, we do not maintain a penitentiary at Joliet primarily for the purpose of reforming criminals, but we maintain it under the police power of the state to protect the people who are law-abiding against the crime of those who are locked up in this penitentiary. We do not maintain insane asylums solely for curing the insane, but we maintain them for the purpose of protecting society at home, the people who are sane. And so under the police power the people who are well have some rights, as well as the person who is sick and who is employing a physician. It is axiomatic that a person has

"freedom to do all that he wills, provided he infringes not the equal freedom of any other."

DR. M. L. HARRIS: I would like to say a few words in answer to what Dr. Webster has said, and also in answer to the remarks made by Dr. Frank. If you will remember, when I stated that anybody should be allowed to practice medicine I said every individual had an inalienable right to employ whomsoever he pleased. I put it "the adult, sane individual." Everybody will recognize that inalienable right. I did not say anything which would imply what Dr. Webster has said. I would raise the standard so high that we would be ashamed of every medical practice act in this country, including Illinois. Under my plan, the man who treated a case of diphtheria by ignoring the rights of others would be in Joliet. I would have the standard raised so that the board could certify to the people that this or that man is qualified to practice medicine, and that is as far as the Board should go. The criminal law should do the rest.

## THE CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING OF THE SOCIETY, WAS HELD NOVEMBER 15, 1912, THE PRESIDENT, DR. RUDOLPH HOLMES, IN THE CHAIR

DR. EUGENE CARY (by invitation) read a paper entitled "Chorio-Epithelioma Recurrence After Three Years, Invasion of the Spinal Canal, Villi in Secondary Growth (See p. 362)"

DR. WEBSTER. I think we are favored in having this case worked up so thoroughly by Dr. Cary. Perhaps we would not have been so favored had not the physician of the patient, Dr. Slaymaker, been closely associated with Rush Medical College, and urged the advisability of a careful autopsy by Dr. Le Count. The case interested me very much at the time. Dr. Lynch has just reminded me that I reported its clinical features before the Society shortly after I operated for the pelvic disease. At the time of the operation a very unique feature was the presence in the left broad ligament of a mass the size of a large orange, consisting mainly of grape-like masses somewhat resembling a hydatid mole. An extension of these gray masses was found in the enlarged left ovarian vein. The appearance of the swelling brought to mind the rare tumor described years ago as racemose sarcoma.

This case emphasizes one point: that in doing a hysterectomy for chorio-epithelioma one

should never choose the vaginal route, because it is very important to remove the affected parts entire and with as little disturbance as possible. The abdominal operation alone should be employed.

DR. CARY. I have nothing more to say. These sections show the villi in the mass which Dr. Webster described as having been shelled out of the broad ligament.

DR. WEBSTER: The specimen exhibited tonight is incomplete. A considerable portion of the chorio-epithelioma was thrown away at the time of operation.

DR. DORLAND: I would like to ask regarding the frequency of these cases following labor at full term, or abortions, or compared with cystic disease of the chorion. As I understand, most of the cases occur subsequent to cystic disease.

DR. CARY: The condition occurs after each of these conditions, probably most frequently after hydatiform degeneration of the chorion. It may also follow ectopic gestation.

DR. J. CLARENCE WEBSTER reported the following cases:

CASE 1. Imperforate anus and cystocele.

Mrs. S., aged 34, married 12 years, admitted to Presbyterian Hospital, October 14, 1912.

*Complaint.* Falling of womb. A mass protrudes from the vulva except when she is in bed. It followed an instrumental labor eight years previously. Since infancy there has been no control over the fæces. A pad has to be worn over the vulva continually. Every few months she has bloody diarrhœa.

On *examination*, there was found to be great relaxation of the tissues around the vulva, four fingers being easily admitted into the latter. There was considerable prolapsus of the anterior vaginal wall, bladder, and uterus. There was no anal opening. At the normal site there was a depression of the skin which was pigmented. On irritating the surface, contraction of subjacent muscular tissue seemed to be produced. The bowel opened into the vulvar orifice at the lower end of the vagina, where there was some protrusion of the bowel mucosa.

*Operation.* Anterior colporrhaphy was first carried out. The lower end of the bowel was then dissected from surrounding tissues for nearly two inches. An opening was made through the skin and subjacent muscle at the site of the anus. The bowel was pulled down and stitched to the edge of the skin opening except posteriorly, where an opening was left for drainage. Repair of the perineum was then carried out. The patient made a good recovery, leaving the hospital on November 6th with a good pelvic floor and having control of the anus.

The condition was one of congenital defect, in which the rectal part of the anal plate had persisted, the cloacal septum having failed to fuse with the perineal septum. The urogenital sinus was only partially separated from the rectum, so that a communication was left between the rectum and the lower end of the vagina.

It is interesting to note that the anal sphincter was developed at the site of the anus and not around the end of the bowel.

**CASE 2.** Large myofibroma of the ovary, ascites and extreme procidentia. Mrs. W., aged 68, admitted to Presbyterian Hospital October 14, 1912.

*Complaint.* Gradual enlargement of the abdomen during the previous six years, with tension of the skin. "Falling of the womb" first noted about six and one half years ago, having become more marked, so that now there is a mass outside the body about five inches in diameter. Loss of weight. Frequency of micturition, pencil-like stools. The patient states that she noticed something hard in the abdomen 12 years previously.

On *examination*, the abdomen was tense and markedly distended. Signs of free fluid were present. There was an irregular, hard mass in the lower half of the cavity.

There was a marked procidentia, the bladder, vaginal walls, uterus, and part of the rectum being external to the body, the surface being tense owing to the pressure of the ascitic fluid. It was ulcerated in several places.

*Operation.* On account of the poor condition of the patient's pulse and the presence of casts and albumin in the urine, the abdomen was opened under local anæsthesia, a solution of novocain  $\frac{1}{16}$  being employed. Several quarts of clear ascitic fluid escaped. Occupying the lower abdomen was a solid tumor measuring 20 x 15 x 8 cm. It was attached to the left broad ligament by a short stalk about 8 cm in diameter containing no visible vessels. There was no ovary on this side, and the tumor was evidently developed from this structure.

On the right of the uterus the tumor was attached chiefly to the bladder, and slightly to the inner end of the right Fallopian tube and adjacent part of the uterus, the area of attachment being about two inches in width and consisting mostly of veins and arteries of considerable size. These evidently formed the main supply to the tumor, which had thus implanted itself, having almost entirely lost its original vascular supply from the left broad ligament. The omentum and ileum were adherent to the tumor over small areas. The patient made a good recovery.

A careful examination of the tumor was made by Dr. Eugene Cary, who reported that it consisted chiefly of non-striped muscular tissue with some fibrous tissue. After nine days extensive plastic work was carried out under local anæsthesia for the repair of the pelvic floor. The patient left the hospital on November 19 in good condition.

**CASE 3.** Large unilocular blood cyst of the wall of the uterus. Miss W., aged 28, admitted to Presbyterian Hospital September 23.

*Complaint.* Abdominal fullness. Fifteen months previously she noted that her clothes were tight. Since that time there has been no noticeable increase. Her health has been good. Menstruation was normal, 28-day type, of 4 to 5 days' duration.

On *examination*, a mesial swelling was found in the abdomen, extending eight inches above the pubes. It was tense and elastic and had all the characteristics of an ovarian cystoma. The body of the uterus could not be felt apart from the tumor.

**Operation.** On opening the abdomen, the tumor was found to be continuous with the body of the uterus, the ovaries and tubes being distinct from it. The surface was smooth and glistening, somewhat like the normal uterus in color, many small vessels being seen in the wall. About 3300 cc. of chocolate-colored fluid was withdrawn from the tumor with a trocar, its specific gravity being 1020. The fluid consisted of serum-albumin, containing fibrin-flakes, leucocytes, and red blood corpuscles, more or less disintegrated. Supravaginal amputation of the uterus was performed.

The specimen was thoroughly examined by Dr. Eugene Cary, who reports that the cyst had developed in the upper part of the uterine wall and that it contained one main cavity with two small subdivisions. It did not communicate with the uterine cavity.

The lining of the cavity was smooth and was covered with endothelium-like cells, proliferated in various parts. It was well vascularized. Here and there blood spaces were found in the wall of the cyst. The wall contained no glandular spaces of any kind.

This case is the second which has occurred in my experience. The first was recorded by me in the *American Journal of Medical Sciences*, March 1895. The specimen which I then described was, I believe, the first of its kind recorded in literature. The cyst was larger than the one described to-night and was remarkable in having developed in the wall of the uterus in a woman aged 53, three years after the menopause. It resembled the present specimen very closely and probably arose from the enlargement of one of the spaces of a cavernous angioma which occupied the fundus of the uterus, from which the cyst developed. The specimen described this evening probably had a similar origin. There was no indication that either cyst arose from Müllerian glands or Gartner's ducts.

**DR. LYNCH:** I would like to ask whether there was any evidence of the sphincter of the bowel in the pelvis. It seems to me that this case is very interesting from the standpoint of the sphincter. It is the second case that has been reported here. There was a case of colotomy reported by Dr. Eisendrath. That case was shown with a double uterus, and there were evidences of the sphincter being left in the pelvis. I believe this is comparatively rare in the literature.

**DR. CURTIS:** I would like to ask Dr. Webster regarding that fibroid. Was the cause of the development of this fibroid the circulation in the ovary, or was there too much pressure on the blood-vessels? In regard to cysts of the uterus,

two others have been described. One was reported in the *Zeitschrift für Gynäkologie*. In that case it developed from the remains of the Gartner duct. In the second case it developed from the lining of the uterus.

**DR. WEBSTER:** Fibroma of the ovary may or may not be associated with ascites. Dr. Reuben Peterson found that it was present in about 40 per cent of cases. As regards the uterine blood cysts, there is no evidence that they arose from Müllerian glands or Gartner's ducts.

**DR. HOLMES:** I wish to report a case of extra-uterine pregnancy, which is of interest on account of the early appearance of rupture due to the fact that the gestation occurred in infantile generative organs.

The patient was 25 years of age, her menstrual life began at 13, and from the onset the periods recurred with unusual regularity, almost to the hour on the twenty-eighth day. The flow invariably lasted but a few moments — at most a few drops of blood stained the clothing. When she was 20 I examined her to ascertain the cause of the scanty flow. The uterus was infantile, hardly a third of the normal size. Her marriage took place on June 19. She menstruated on June 25 and July 23. On August 24 she was seized with dizziness and abdominal pain. On reaching home, a half-mile distant, she had an attack of nausea and vomiting. The next day she had some abdominal discomfort, and for the next two or three days she had occasional slight metrorrhagia. Seven days after the onset of symptoms I examined her and found a small mass to the right of the uterus, this mass was certainly no larger than a normal ovary, and the ovary was not palpable. A couple of hours after the examination I opened the abdomen and found some free fresh blood in the lower abdomen. The right tube was enlarged to a thickness of 3 cm., perhaps 4 in length, with a small rupture on the posterior aspect. This was removed, as a retroversion was present, this was corrected by suturing the round ligaments to the posterior wall of the uterus by the Webster operation. The uterus showed little if any effect from the influence of the tubal pregnancy, the ovaries were less than half the normal size, the broad ligaments were exceedingly diaphanous — so delicate and transparent that the finger was clearly visible through their texture. Microscopic examination showed blood and an occasional poorly developed villus.

**DR. RIES** presented a case of chorionic villi in the uterine wall eighteen years after a pregnancy, in which he stated that in regard to chorio-epithelioma there are two hypotheses: one, the hypothe-



sis of congenital misplacement, and the other, the *hypothesis of parthenogenesis, possible of course, in females only*. In the first case, we have the villi passing from one part of the fetus into another. In the second place, if the ovum goes on to the stage in which it develops a protoplast and the other tissues fail to develop these protoplasts, then the protoplast becomes quiescent and we would find that the chorio-epithelioma remains. As you all know, chorio-epithelioma may develop inside of the uterus or outside of the uterus. On what side do they develop if the uterus is normal? The chorio-epithelioma is then outside the uterus. Leopold in 1889 did some work on this subject, I did some work in 1894, and Meyer did some work later.

The epithelial covering of the chorionic villi has been found to invade the uterus and has been found in the uterine wall. The chorionic villi are said to disappear within a very few weeks after labor, but we can see the chorionic villi in the uterine wall.

We have had under observation a case of the development of the chorionic villi on the outside of the uterus. A woman, 45 years of age, came to me in April, 1912. She was a native of British Guiana, and married. She had had four full-term pregnancies, terminating in normal labor with normal deliveries. There was a normal history of the pregnancies, no history of hemorrhage. The last full-term pregnancy was 20 years ago. Since then she has had two abortions, the last one 18 years ago. Both of these abortions came about naturally — were not induced. The last one was terminated without medical interference with no hemorrhage, and to all intents and purposes was regularly completed. She continued in good health until four years ago, when the periods of the four-day type began to last from seven to ten days. She came to the hospital, and we found on examination that she had an irregular fibroid mass back of the uterus on the left side. I did a vaginal operation. The interest of the case is purely in the findings. We found the cervix lined with some translucent material. We could easily see that this had been there for some time. I removed a portion of the tissue for microscopical examination, and an examination was also made of a piece taken from the tube. It consisted of connective tissue, some capillaries, with some erythrocytes. There were blood-vessels in these villi, and their surface was covered with flat epithelial cells. It is clear that this covering is the same as an endothelium. It is evidently an epithelium that is covering these villi. We have nothing to show that these were villi which had invaded the

uterine wall. It is important to notice that a great many of these villi lined the capsule of the small fibroid. Many of these had little attachments in the hyaline tissue. The cavity of the uterus is perfectly smooth.

I called them villi because of their size, shape and ramifications, and because there was no evidence of vessels. You cannot call them thrombi, because thrombi have vessels. I know of no other condition that would fill such a condition except villi. There is nothing like this case in the literature as far as I am able to find out. We have had fibroids of the uterus with a destruction of the villi in the uterine wall. From the work of Rokitsansky we learn that a fibroid of the uterus encourages the growth of villi in the uterine wall because of the growth of the fibroid. If they can remain for 18 years, there is no reason why they cannot live for a longer time. We do not know if any of the chorio-epithelioma covering has disappeared in this case. We do not know there were villi in this uterus all this time. I believe that the chorio-epithelioma covering is a good reason why there was chorio-epithelioma present.

DR HOLMES: The paper is open for discussion.

DR. WEBSTER: I think we must regard the communication as a very important record if it is reliable. How can we be sure that this woman did not have pregnancies or abortions years after the date given? But even if that were so, the case would be interesting. The villi appear to belong to the second half of gestation. I take exception to the statement that the covering of the villi has disappeared. It seems to me to be present at least in some of the slides. The continuity of the connective tissue of the villi with that of the uterus is interesting and is similar to that which may be found in normal gestation. The feature of interest is, however, the extension of maternal blood into the vessels of the villi. This is not found in ordinary pregnancy.

DR. SCHMIDT: Dr. Ries has given us a short review of the etiology of chorio-epithelioma. There are a number of cases reported in which this growth did not start before six years after labor and the case of Halliday-Croom, in a woman about 70 years old.

In my review of chorio-epithelioma I have always advanced the opinion that in these cases a short pregnancy has been overlooked, manifesting itself only in a prolonged or abundant menstruation. We do not know much about the age of human cells. Our brain cells are probably the longest living cells. But in the specimen presented to-night we have to deal with a complete organized structure, whole villi, and it is absurd

to attribute to them such a long vitality without any proliferation, even if they are situated within a blood-vessel.

DR. STAHL: I agree with Dr. Schmauch, and also with the suggestion of Dr. Webster that Dr. Ries clear up the question as to the probable period of development of his specimens. To me it has been a great pleasure to listen to Dr. Ries in his presentation of his subject-matter, his views, his theories, and his queries. The Doctor is usually encyclopædic in exposition and explanation. But has he not overlooked some original work bearing upon this subject-matter, presented by a member of this society as far back as 1902? He mentions with interrogation hypotheses and theories extant to explain the origin of tumors, and especially these tumors, the chorio-epitheliomata, and that such expressions of tumor development occur alike in the male, the female, and the virgin. That such types of tumor should occur in the male, female, and virgin, extraordinary as it may seem, is what my studies would lead me to anticipate. One of the theories he discusses, and perhaps the most weighty, is the one conveyed in the term "latent" and "delayed latencies." This theory was dwelt upon in an article read before this society and published in the *American Journal of Obstetrics* (Vol. xlii, No. 6, 1902), and again discussed in a preliminary report, "The Decidual Cell Structure Contrasted with the Syncytial Nuclei (Langhans Cells) and Nuclear Proliferation Tissue," *American Journal of Obstetrics* (Vol. liii, No. 4, 1906). There the writer speaks of the nuclei and nucleoli as follows.

"It is these wandering nucleoli that cause the decidual metamorphosis in the pregnant mucosa and assist in decidual loss of tone anticipatory of the more active destruction and absorption process of the maturer nuclei (the Langhans cell). These nucleoli are not only found scattered throughout the decidua, but are found throughout the general tissues of the mother. The 'cell detritus theory' notwithstanding, and though it is accepted by many as the causative factor of the maternal metamorphoses of pregnancy, I still maintain that these metamorphoses are caused by the inherent qualities of these wandering nucleoli. It is these wandering invading nucleoli, with their syncytial plasm covering, possessing their peculiar chemico-physiologic function, that forms the unit or the greater part of the unit that induces not only the decidual metamorphoses, but all the other metamorphoses which occur throughout the maternal histology and physiology during pregnancy, and its sequelæ as hydatid mole, syncytioma, and their metastases.

"Cohnheim's theory of the origin of tumors is based upon the theory of retention in mature tissues of embryonal elements. One of these elements, I advance, is formed by these nucleoli, which wander, are included in, and remain latent among mature tissues. When they awake to activity there is seen an extremely active proliferation of nuclei and nucleoli and a plasm without cell boundary, with destruction to their environment much like that seen in the activities of the nuclei and nucleoli of the syncytium, and in the active proliferation of the nuclei and nucleoli of the carcinomata."

Dr. Ries invites the question: What are these structures he shows under the microscope; are they villi? To me they read a histological structure characteristic of the villi of about the fifth to seventh month of development. Not later, for they show a thinning of the outer syncytial structure with a single, in some places a double, row arrangement of Langhans nuclei, a progressive attenuation characterizing the latter half of development of the syncytial expression. As Prof. Minot says: "Towards the end of pregnancy, however, the epithelium of the villi undergoes great alteration. On the larger villi a true epithelial investment has almost entirely disappeared, and instead isolated accumulations of large round nuclei are found, and form protuberances (Zellknoten, or cell-patches) on the surface of the villi. Nor are the specimens earlier than three months, for they do not show that swollen, thickened amœbic picture of the active syncytium of the early villi."

Dr. Ries speaks of his specimens as an expression of a late "latency" development, and occurring in a blood-vessel. That such a tumor may develop in such manner and tissue, and with such a causative theory, was intimated in these articles of 1902 and 1906. There, there are histological photomicrographs showing the wandering of the syncytial nuclei and nucleoli into maternal and fetal tissues. There will also be found illustrations of the pulmonary metastases in Dr. Bacon's case of deciduoma malignum, originally reported in the *American Journal of Obstetrics* (Vol. xxxi, 1895). Dr. Ries some time ago (its discussion should also be found in the transactions of our society) kindly loaned me some slides showing Langhans nuclei among the cells of the liver. This wandering of the syncytial nuclei and nucleoli is normal, their decadence is normal. However, some persist, survive their environment, and remain quiescent, thus becoming latent. When aroused there is the tumor, the metastasis, in and of any tissue. It may be ten

weeks, ten months, ten or more years after the original wandering and latency.

DR. LYNCH: The case is interesting to me. It was originally considered that the villi were of the one or two months' type. It seems to me that they are the villi of the fourth month of pregnancy. These villi were very uniform. It seems to me that we could make out the chorio-epithelioma. In their structure the blood-vessels were uniform in shape, while in pregnancy the blood-vessels are altered. We will find these villi in the tissue even years after pregnancy.

DR. WEBSTER: I would say that I first examined these villi with the low power, but later have examined them with the high power. The covering appears to be chorionic epithelium similar to that found in the second half of normal pregnancy.

DR. RIES: I am glad to hear this discussion regarding the covering of the villi. If it were as generally supposed, it would suit my diagnosis. The observations which Dr. Webster made are interesting, and we should remember that the chorio-epithelioma fills complete sinuses. I have studied the covering of this villus for many weeks, and have gone over these sections repeatedly with both high and low powers. There is no question but this is a definite epithelioma. I have not been able to see with the high power any of the chorionic villi. The case, of course, is an interesting case.

DR. SCHMAUCH: I only want to mention a similar case that appears in European literature by Divitsky. That case occurred 75 years ago.

## CORRESPONDENCE

### PREPARATION OF WAXED SILK

TO THE EDITOR. So many requests have been made of me for the method of preparation of the waxed silk which has been in use by me since 1880, that I have thought it desirable to ask you to publish it.

Dr. Moses Gunn, in 1874 after a visit abroad, brought back from England with him as a gift from Sir Joseph Lister, a supply of the then wonderful "phenic acid." This he added to melted pure yellow beeswax in the proportion of 10 per cent by weight of the crystals. Into this melted mixture he dropped pieces of silk of suitable lengths wound upon squares of cardboard, and allowed them to remain there until the bubbles of air ceased to rise from the silk as the wax permeated its interstices. These pieces of cardboard were then picked out of the melted wax, the excess of same allowed to drip off, and when thus drained were put in a proper receptacle and were ready for use. Such silk constitutes when prepared to-day after modern antiseptic and aseptic technique, the oldest ideal suture—an antiseptic "wax end."

During all these years I have tried every form of suture as it has arisen, only to return to this ideal suture material. To-day the silk is cut in proper lengths, wound upon pieces of cardboard which are then folded in pieces of paraffin paper and put in an envelope with the size and length of the suture inscribed upon it. These packets

are then dry sterilized in bulk in ordinary dry sterilizer. When a sufficient quantity has been made, the envelopes are opened, the silk cards are immersed in the 10 per cent carbolic melted beeswax under the usual modern aseptic precautions, and when saturated are returned to the envelopes. Before using, the silk should be rapidly drawn through a sterile towel. This produces enough friction to partly melt the wax and thus polish the silk, just as the shoemaker polishes his wax end.

This suture material then possesses all the desirable qualities of any suture material. It is solid like silver wire, smooth like silkworm, unirritating, it may be buried, is stronger for the size than the unwaxed, and has as its nearest imitator, Pagenstecher linen. It makes the ideal suture for delicate structures like the peritoneum, intestinal anastomosis, dura and skin. It seems to have just sufficient antiseptic effect from the carbolic acid to permit its remaining from 10 to 14 days without exciting suppuration if the skin be sterile at the time of insertion.

Emphasis should be laid upon the necessity of securing *true beeswax*, not the "improved" bleached variety which is usually paraffin, as well as 100 per cent phenic acid.

"Try all things,  
Hold fast to those which are true."

LEWIS L. McARTHUR.

## BOOK REVIEWS

**SURGERY OF DEFORMITIES OF THE FACE** By John B Roberts, A. M., M. D. New York: William Wood & Co., 1912

This volume deals exclusively with surgical deformities of the face and consequently a more careful study of the principles underlying such malformations is undertaken than is seen in works on general surgery.

The first chapter is historical and refers to publications of methods and successes of Tagliacozzi of Bologna in 1597. Reference is made to rhinoplastic and other operations which were practiced in India centuries before where mutilations of the face were in vogue as a punishment for crime.

Considerable space is given to the study of the facial anatomy and contiguous parts which influence surgical interference.

Surgical skin diseases are discussed with deformities of the mouth, lips, and ears, as well as conditions resulting from faulty development along the various clefts, especially of the palate and lip.

In general, well known operations are described, and the results attained by the author in this special field are reported.

H. A. POITS

**SURGICAL DISEASES OF CHILDREN** By Wm Francis Campbell, M. D., and Le Grand Kerr, M. D. New York and London: D. Appleton & Co., 1912

This book contains many things which will be of great use not only to the man practicing surgery but to the man practicing pediatrics. Symptomatology is gone into slightly, especially with regard to those symptoms which would be of most value to the surgeon. The question of pain is described at great length, the value of the X ray is discussed, anesthesia receives minute attention, as does the post-anesthetic care, and the after treatment of the patient is taken up in detail, as is also the treatment of shock. Constitutional diseases which have a bearing on surgical procedure, such as hæmophilia, scurvy, lymphatism, rickets, receive due attention, especially in relation to surgery.

The rest of the book is taken up with the various surgical procedures in regard to diseases which occur more frequently in children and stress is laid on those conditions which are most frequently encountered or are peculiar to this time of life. The book is well illustrated, very complete, and can be recommended to one engaged in almost any general or special practice in medicine. C. G. GRUFFT.

**ANÆSTHETICS AND THEIR ADMINISTRATION** 4th edition By Sir Iredene W. Hewitt, M. V. O., M. A., M. D. London: Macmillan Co. Ltd., 1912

This volume is without doubt the best and most complete on the subject of anesthetics to date, and should be in the hands of every student who is taking more than a passing notice of anesthesia, one of the most important branches in the department of surgery. It is handled to best advantage under well selected topics, each chapter approaching it from a different standpoint. The chapter on the evolution of anesthetics is fairly complete, but a volume of this size should deal more fully with the scientific apparatuses that are now in use which deliver accurate percentages of gas and ether vapor to the patient, thereby maintaining a more even and consequently a more quiet anesthesia which is the ideal both as regards safety and efficiency.

I believe also that too much space is devoted to the advocacy of chloroform and formulae containing this drug and too little to the harmful after-effects which it is well known to produce.

The chapter on the Physiology of Anesthetics is interesting and practical for the student, particularly the discussion of the muscular phenomena in surgical anesthesia.

In the chapter on Morphine and other Alkaloids in Conjunction with Anesthetics, the author correctly takes the position that preliminary narcotics in properly selected cases are a distinct advantage to the patient taking an anæsthetic.

His chapter on the Caution and Treatment of Respiratory and Circulatory Failure is well written and how to meet the contingencies is well illustrated throughout the text by clinical data which the author has so abundantly supplied from his case records. T. L. DAGE.

**SPEZIELLE CHIRURGISCHE DIAGNOSTIK FÜR STUDIERENDE UND ÄRZTE** 3rd edition By Dr I. de Quervain Leipzig: F. C. W. Vogel

The third edition of this valuable book, coming so soon after the earlier editions, demonstrates the favor with which it has been received by the surgical profession. It is well worthy of many editions and is recognized to-day as one of the best volumes upon surgical diagnosis. The present edition is enlarged at some points and all the chapters have been rearranged to bring them up to date. It is a volume of 730 pages, well illustrated and clearly written, and should be in the hands of every American surgeon who is familiar with the German language.

**SURGICAL AFTER TREATMENT.** A manual of surgical convalescence. By I. R. G. Crandon, A. M. M. D., and Albert Ehrenfried, A. B., M. D. Philadelphia and London: W. B. Saunders Co., 1912.

This second edition contains not only the revised text of the first edition but much subject matter which, according to the consensus of opinion, has marked an advance in surgical practice.

This volume is of value to hospital internes whose training in after treatment and recognition of sequelae is quite largely traditional to the hospital in which they are engaged, and will serve to broaden their comprehension and experience, being based as it is upon the experience of other men whose work has been in other hospitals. To the physician practicing in the country and smaller towns away from surgical centers where the surgeon relies largely upon the house physician to observe the patient after operation these methods and suggestions are of especial value, as many times the surgeon who operates cannot remain to take care of the case. The chapter on vaccine therapy is written by Dr Geo. P. Sanborn a pupil of Sir A. F. Wright which fact bespeaks its scientific and practical worth.

H. A. Potts

**THE COLLECTED WORKS OF CHRISTIAN FENGER, M. D.**  
Two volumes. Philadelphia and London: W. B. Saunders Co., 1840-1912.

The appearance of this work which comes in the expression of the affectionate devotion of the Fenger Memorial Association, established to perpetuate the memory of this great man is significant of the idealism of our noble profession. We must rejoice that, in the midst of competition which is necessarily of a personal and insistent character there are evidences now and then of deep and spontaneous feeling in the common recognition of true greatness.

Dr Fenger's life was one of great activity in the cause of suffering humanity. By taking the attitude of scientific investigation and study he was able to do his work and not be overwhelmed by the pain which must come to those who view at close hand and deal practically with the ailments of humanity. Dr Fenger had a heart as tender as that of a woman and when great misfortune came to his surgical efforts he knew how to give way and find relief in the ways permitted to men.

No medical man should fail to read this remarkable autobiography that this great man wrote for the Danish Government upon the occasion of his receiving the Order of the Knight of Dannebrog.

The estimation of the value of Fenger's work will be the agreeable task of succeeding generations of students of his papers and of the history of American and universal surgery.

Like all great men, he was really greatest in him-

self and to know him was infinitely more than to know all his works. To grasp his persistent effort to maintain an attitude of strict regard for the scientific truth was far more of an education than the study of his wonderful papers, the observation of his painstaking care of his patients or the following of his excursions into the field of surgical history and achievement.

For no one who knew him could possibly forget his entire honesty of thought and action. Truth for him was of far more importance than success. His statistics of his own work were presented with such a frankness as to inspire every man who had a spark of idealism in him.

It was Fenger's joy to range himself in thought with the heroes of modern surgery, those who have sacrificed their whole lives day and night, year after year to the ideal of relieving human suffering in the masterful way which belongs to surgeons. Always ready upon his tongue was the history of the work of Dieffenbach, Langenbeck, Billroth, V. Pitha, Ollier. The long list of gynecologists our American McDowell among the first French, Scotch, English and German none to be slighted, received his frequent praise and admiration.

Fenger rejoiced in his old world origin, though he spoke little of it and never with the least offense, and was then worthily an American pioneer surgeon. He could never grasp the genius of America but retained a curious innocence of attitude and demeanor to the end. He sympathized with us and our difficulties to the utmost and entered wholeheartedly and sweetly into their solution. Nothing could be more idyllic than the long struggle which he made with his broken English his awkward manners and his poverty to gain entrance into the confidence of the American medical profession. During this long period it was quite enough for him to do each day's work as it came. He never carried out a large work, never wrote a *magnum opus*, but lived and wrought in the confidence of the value of his daily labor.

It is because he cared so little about the showy side of his work, so much for its deeper meaning and inherent truth that his pupils cherish so strong an affection and reverence for him and have gladly co-operated to the production of these volumes.

Prof. Hektoen and Dr. Burton deserve the thanks of the whole profession for their self-sacrifice in doing the work which was required. The amount of effort involved is by no means apparent upon a first glance at the books, since so much in the way of editing had to be done. We therefore all the more feel our obligation to the editors and bespeak for them the gratitude of all readers.

The collected works of Christian Fenger deserve a place in the library of every thoughtful surgeon and physician beside the Autobiography of Marion Sims and the Letters of Theodor Billroth.

WELLER VAN HOOK

# Clinical Congress of Surgeons of North America

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FOURTH ANNUAL SESSION

CHICAGO

NOVEMBER 10 TO 15, 1913

# CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

EDWARD MARTIN, President  
GEORGE F. BREWER, President-Elect

W. W. CHAPMAN, Vice-President-Elect  
FRANKLIN H. MARTIN, General Secretary

ALLAN B. KANAVEL, General Treasurer  
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## COMMITTEE ON ARRANGEMENTS FOR THE CHICAGO MEETING

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CARL BECK  
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JOHN L. PORTER  
HOLLIS E. POTTER  
EDWIN W. RYERSON  
LOUIS J. SCHMIDT  
W. E. SCHROEDER  
D. A. K. STEELE  
GEORGE F. SLEKER  
THOMAS J. WATKINS  
J. CLARENCE WEBSTER  
WM. H. WILDER  
CASEY A. WOOD

## PREPARING FOR THE CLINICAL CONGRESS IN CHICAGO

SINCE the first session of the Clinical Congress held in Chicago in November, 1910, this city's clinical facilities have been very largely increased through the erection of new hospitals and the enlargement and improvement of older institutions. Naturally, its capacity for entertaining visiting surgeons is likewise increased.

The clinicians of Chicago fully appreciate the advantages and also the responsibilities connected with a session of the Clinical Congress and are determined that nothing shall be left undone to maintain Chicago's prestige as being the leading surgical center on this continent.

On the following pages is presented a preliminary or provisional outline of the clinical program for the fourth session of the Congress to be held in Chicago, November 10th to 15th, 1913. The several committees having in charge the work of arranging the various sections of the program report their work as only fairly started. The program as here presented therefore is not complete as to the number of operators or the number of clinics to be held by each. The

program is to be corrected and amplified until a full representation of Chicago's clinical facilities is made.

The Historical Committee has in preparation a series of papers dealing with the men and institutions which have helped to make Chicago world famous as a medical and surgical center. In an early issue there will be presented sketches of the lives of the early day surgeons, to be followed by papers dealing with its medical schools, hospitals, laboratories, societies, etc.

The Committee on Evening Meetings expects to present at an early date a preliminary outline of the programs for the evening sessions. Several prominent European surgeons have accepted invitations to read papers before the Congress and in addition a number of well known American surgeons will participate. It is planned to have sessions on every evening except Saturday, November 15, and on Tuesday, Thursday, and Friday evenings there will be separate meetings for those men who are especially interested in surgery of the eye, ear, nose, throat and mouth.

## SURGICAL CLINICS

COMMITTEE A J OCHSNER, Chairman, CARL BECK, FREDERIC A BESLEY, and LAWRENCE RYAN

## Monday, November 10th

- A J OCHSNER — Augustana Hospital — 8 to 11  
 A P HILNECK — Jefferson Park Hospital — 10 to 12  
 G H WYNNEKOOP — Lake View Hospital — 10 to 12  
 E WYLLYS ANDREWS — Michael Reese Hospital — 9 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 11  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G BECK — North Chicago Hospital — 9 to 11  
     Bismuth work only  
 S DAVIL — Norwegian Deaconess Hospital — 9 to 11  
 M L HARRIS — Polyclinic Hospital — 11  
 NORMAN KIRK — Polyclinic Hospital — 11  
 J R PENNINGTON — Polyclinic Hospital — 2 to 4  
 ARTHUR DIAN BLAAN — Presbyterian Hospital — 11 to 1  
 C G BUFORD — St. Joseph's Hospital — 2  
 CARL WAGNER — St. Joseph's Hospital — 10 to 11  
 W H ALLPORT — St. Luke's Hospital — 2  
 T A DAVIS — West Side Hospital — 1 to 4  
 J A FOWLER — Willard Hospital — 11 to 12

## Tuesday, November 11th

- N M PERCY — Augustana Hospital — 8 to 10  
 C G BUFORD — Children's Memorial Hospital — 2  
 JACOB FRANK — Columbus Hospital — 8 to 12  
 LAWRENCE RYAN — Cook County Hospital — 8 to 11  
 A G ZIMMERMAN — German Hospital — 9 to 12  
 PAUL GRONLUD — German Hospital — 10 to 12  
 C I WYNNEKOOP — Lake View Hospital — 8 to 10  
 F WYLLYS ANDREWS — Mercy Hospital — 8 to 10  
 L A GREENSFELDER — Michael Reese Hospital — 8 to 10  
 L L McARTHUR — Michael Reese Hospital — 9 to 11  
 D N EISENDRATH — Michael Reese Hospital — 9 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 12  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G BECK — North Chicago Hospital — 9 to 11  
     Bismuth work only  
 WM R CUBBINS — Post-Graduate Hospital — 2 to 6  
 C H McKENNA — St. Joseph's Hospital — 9 to 11  
 C M McKENNA — St. Joseph's Hospital — 9 to 11  
 A E HALSTEAD — St. Luke's Hospital — 8 to 11  
 AXEL WERELIUS — South Shore Hospital — 9 to 12  
 W E SCHROEDER — Wesley Hospital — 8 to 10  
 F A BESLEY — Wesley Hospital — 10 to 12

## Wednesday, November 12th

- A G ZIMMERMAN — Alexian Brothers Hospital — 9 to 11  
 A J OCHSNER — Augustana Hospital — 8 to 11  
 WM FULLER — College of P and S — 1 to 3  
 WM M HARSHA — College of P and S — 1 to 3  
 CARL BECK — Cook County Hospital — 1 to 4  
 J V FOWLER — House of Correction — 9 to 11  
 E I TORELL — Lake View Hospital — 9 to 10  
 G H WYNNEKOOP — Lake View Hospital — 10 to 12  
 J B MURPHY — Mercy Hospital — 8 to 12

- E WYLLYS ANDREWS — Michael Reese Hospital — 9 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 11  
 CARL BECK — North Chicago Hospital — 9 to 11  
 J R PENNINGTON — Polyclinic Hospital — 2 to 5  
 LAWRENCE RYAN — St. Anthony's Hospital — 10 to 12  
 CARL WAGNER — St. Joseph's Hospital — 10 to 12  
 A E HALSTEAD — St. Luke's Hospital — 8 to 11  
 CHARLES DAVISON — University Hospital — 1 to 3  
 A P HILNECK — West Side Hospital — 8 to 10

## Thursday, November 13th

- N M PERCY — Augustana Hospital — 8 to 10  
 A J OCHSNER — College of P and S — 1 to 3  
 N M PERCY — College of P and S — 1 to 3  
 JACOB FRANK — Columbus Hospital — 8 to 12  
 LAWRENCE RYAN — Cook County Hospital — 8 to 10  
 E WYLLYS ANDREWS — Cook County Hospital — 9 to 12  
 A P HILNECK — Cook County Hospital — 1 to 3  
 A G ZIMMERMAN — German Hospital — 9 to 12  
 PAUL GRONLUD — German Hospital — 10 to 12  
 H R CHILSLITT — Hahnemann Hospital — 8 to 10  
 C E KALLAL — Hahnemann Hospital — 8 to 10  
 C I WYNNEKOOP — Lake View Hospital — 8 to 10  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G BECK — North Chicago Hospital — 9 to 11  
     Bismuth work only  
 M L HARRIS — Polyclinic Hospital — 11  
 NORMAN KIRK — Polyclinic Hospital — 11  
 ARTHUR DIAN BLAAN — Presbyterian Hospital — 11 to 1  
 C H McKENNA — St. Joseph's Hospital — 10 to 12  
 C G BUFORD — St. Joseph's Hospital — 2  
 A E HALSTEAD — St. Luke's Hospital — 8 to 11  
 W H ALLPORT — St. Luke's Hospital — 2  
 AXEL WERELIUS — South Shore Hospital — 9 to 12  
 D A K STEELE — University Hospital — 1 to 3  
 F A BESLEY — Wesley Hospital — 4 to 6  
 C C ROGERS — Willard Hospital — 10 to 12

## Friday, November 14th

- A G ZIMMERMAN — Alexian Brothers Hospital — 9 to 11  
 A J OCHSNER — Augustana Hospital — 8 to 11  
 F A BESLEY — Cook County Hospital — 10 to 12  
 A E HALSTEAD — Cook County Hospital — 10 to 12  
 G H WYNNEKOOP — Lake View Hospital — 10 to 12  
 E WYLLYS ANDREWS — Mercy Hospital — 8 to 10  
 L A GREENSFELDER — Michael Reese Hospital — 8 to 10  
 L L McARTHUR — Michael Reese Hospital — 9 to 11  
 D N EISENDRATH — Michael Reese Hospital — 9 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 12  
 CARL BECK — North Chicago Hospital — 9 to 11  
 J R PENNINGTON — Polyclinic Hospital — 2 to 4  
 CARL WAGNER — St. Joseph's Hospital — 10 to 12



W E SCHROEDER — Wesley Hospital — 8 to 10  
 ALLIEN B KYNWILL — Wesley Hospital — 4 to 6

### Saturday, November 15th

N M PERCY — Augustana Hospital — 8 to 10  
 F G DYAS — College of P and S — 1 to 3  
 JACOB FRANK — Columbus Hospital — 8 to 12  
 L WYLLIS ANDREWS — Cook County Hospital — 9 to 12  
 C L HUMISTON — Cook County Hospital — 10 to 12  
 PAUL I MORI — Cook County Hospital — 1 to 4  
 A G ZIMMERMAN — German Hospital — 9 to 12

H R CHISLITT — Hahnemann Hospital — 8 to 10  
 C F K MILKE — Hahnemann Hospital — 8 to 10  
 C I WYNN KOOP — Lake View Hospital — 8 to 10  
 H A MOJI — Lake View Hospital — 10 to 11  
 J B MURPHY — Mercy Hospital — 8 to 10  
 CARL BICK — North Chicago Hospital — 9 to 11  
 F M G BICK — North Chicago Hospital — 9 to 11  
 Bismuth work only  
 S DAIL — Norwegian Daughters Hospital — 9 to 11  
 PAUL GROSSKUP — Polyclinic Hospital — 2 to 4  
 D W GRAHAM — Presbyterian Hospital — 2 to 5  
 W H ALLPORT — St Luke's Hospital — 2  
 ANGE WRIELIUS — South Shore Hospital — 9 to 12  
 W E SCHROEDER — Wesley Hospital — 10 to 12

## GYNECOLOGICAL AND OBSTETRICAL CLINICS

COMMITTEE J CLARENCE WEBSTER, Chairman FRANK T ANDREWS, CHARLES S BACON and THOMAS J WATKINS

### Monday, November 10th

HENRY BANGA — Polyclinic Hospital — 10  
 FIDODORI J DOI DILLIN — German Hospital — 9  
 FRANK T ANDREWS — Mercy Hospital — 8 to 10  
 EMIL RIES — Post Graduate Hospital — 9  
 WM B HIRING — Rush Medical College — 11  
 ARTHUR H CURTIS — Wesley Hospital — 9  
 ROBERT T GILLMORE — Wesley Hospital — 10  
 MARK T GOLDSTINI — Wesley Hospital — 10 to 10

### Tuesday, November 11th

CHANNING W BARRETT — Polyclinic Hospital — 10  
 A B KIVLS — Polyclinic Hospital — 3 to 4  
 ALBERT GOLDSPOHN — Post Graduate Hospital — 11  
 CARLY CULBERTSON — Rush Medical College — 11  
 W M THOMPSON — St Joseph's Hospital — 9  
 PHILIP S DOANE — St Joseph's Hospital — 2 to 10  
 W S BARNES — Wesley Hospital — 3

### Wednesday, November 12th

HENRY I LEWIS — Cook County Hospital — 3 to 10  
 LESTER FRANKENTHAL — Michael Reese Hospital — 9  
 FRANK W LYNCH — Presbyterian Hospital — 11  
 J CLARENCE WEBSTER — Presbyterian Hospital — 11  
 N SPROAT HEANLY — Rush Medical College — 11  
 F C DUDLEY — St Luke's Hospital — 2  
 ARTHUR H CURTIS — Wesley Hospital — 9  
 MARK T GOLDSTINI — Wesley Hospital — 10 to 10

### Thursday, November 13th

A B KIVLS — Cook County Hospital — 3 to 4  
 FRANK T ANDREWS — Mercy Hospital — 8 to 10  
 C V BACHELL — Polyclinic Hospital — Afternoon  
 HENRY BANGA — Polyclinic Hospital — 10  
 CHANNING W BARRETT — Polyclinic Hospital — 10  
 WM B HIRING — Rush Medical College — 11  
 PHILIP S DOANE — St Joseph's Hospital — 2 to 10

W S BARNES — Wesley Hospital — 3  
 ROBERT T GILLMORE — Wesley Hospital — 10  
 THOS J WATKINS — Wesley Hospital — 9

### Friday, November 14th

A B KIVLS — Polyclinic Hospital — 3 to 4  
 ALBERT GOLDSPOHN — Post Graduate Hospital — 11  
 CARLY CULBERTSON — Rush Medical College — 11  
 W M THOMPSON — St Joseph Hospital — 9

### Saturday, November 15th

LESTER FRANKENTHAL — Michael Reese Hospital — 9  
 FRANK W LYNCH — Presbyterian Hospital — 11  
 J CLARENCE WEBSTER — Presbyterian Hospital — 11  
 N SPROAT HEANLY — Rush Medical College — 11  
 THOS J WATKINS — Wesley Hospital — 9

### Days and Hours to be Announced

CHARLES S BACON  
 I S BILLY — Hahnemann Hospital  
 HENRY F BYFORD — West Side Hospital  
 FRANK CARLY  
 PETER S CLARK  
 JOSEPH B DILLI — Mercy Hospital Wesley Hospital  
 W A MWMAN DORLAND  
 DAVIS S HILLS — Provident Hospital  
 J C ROAG — St Luke's Hospital  
 RUDOLPH W HOLMES — Augustana Hospital  
 GUSTAV KOEISCHER  
 FRANKLIN H MARTIN  
 B A MCBURNEY  
 CHARLES F PADDOCK — St Luke's Hospital  
 CHARLES B RIED — Wesley Hospital  
 ERNEST SURENHAUS — West Side Hospital  
 GEORGE SCHIMMACH  
 I S SIMON — Michael Reese Hospital  
 HERBERT MARION STOW  
 BERTHA VAN HOUSEN — West Side Hospital

## GENITO-URINARY SURGICAL CLINICS

COMMITTEE LOUIS I. SCHMIDT, Chairman, WM T. BELFIELD, ROBERT H. HERBST, GUSTAV KOLISCHER, VICTOR D. LESPINASSE

*Monday, November 10th*

GUSTAV KOLISCHER—Michael Reese Hospital—  
9 to 11

*Tuesday, November 11th*

HERMAN L. KRETSCHMER—Mexican Brothers  
Hospital—8 to 10  
B. C. CORBUS—College of P and S—8 to 10  
HARRY A. KRAUS—German Hospital—4 to 5  
F. KREISSL—Jefferson Park Hospital—2 to 3  
ROBERT H. HERBST—Polyclinic Hospital—4 to 6

*Wednesday, November 12th*

L. F. SCHMIDT—Mexican Brothers Hospital—9 to 11  
F. KREISSL—Jefferson Park Hospital—2 to 3  
GUSTAV KOLISCHER—Michael Reese Hospital—  
9 to 11

*Thursday, November 13th*

F. KREISSL—Jefferson Park Hospital—2 to 3  
ROBERT H. HERBST—Polyclinic Hospital—4 to 6  
J. S. NAGEL—West Side Hospital—3 to 5

*Friday, November 14th*

HERMAN L. KRETSCHMER—Mexican Brothers  
Hospital—8 to 10  
HARRY A. KRAUS—German Hospital—4 to 5  
F. KREISSL—Jefferson Park Hospital—2 to 3  
LOUIS E. SCHMIDT—Michael Reese Hospital—9 to  
11  
B. C. CORBUS—Post Graduate Hospital—3 to 6  
WM T. BELFIELD—Presbyterian Hospital—4

*Saturday, November 15th*

V. D. LESPINASSE—Wesley Hospital—3 to 30.

## ORTHOPEDIC CLINICS

COMMITTEE E. W. RYERSON, Chairman, WALLACE BLANCHARD, CHARLES M. JACOBS, JOHN L. PORTER and HENRY B. THOMAS

*Monday, November 10th*

E. W. RYERSON—Children's Memorial Hospital—  
3 to 6, Polyclinic Hospital—1 to 2  
THOMAS P. LAMM—Home for Destitute Crippled  
Children—2 to 4

*Tuesday, November 11th*

JOHN L. PORTER—College of P and S—9 to 11  
Home for Destitute Crippled Children—11 to 1  
WALLACE BLANCHARD—Home for Destitute  
Crippled Children—2 to 4

*Wednesday, November 12th*

E. W. RYERSON—Children's Memorial Hospital—  
3 to 6, Polyclinic Hospital—1 to 2  
P. B. MAGNUSSON—Home for Destitute Crippled  
Children—2 to 4

*Thursday, November 13th*

HENRY B. THOMAS—Cook County Hospital—11 to  
12  
E. W. RYERSON—Home for Destitute Crippled Chil-  
dren—2 to 4

*Friday, November 14th*

WALLACE BLANCHARD—Home for Destitute Crip-  
pled Children—2 to 4  
E. W. RYERSON—Polyclinic Hospital—1 to 3

*Saturday, November 15th*

C. M. JACOBS—Home for Destitute Crippled Children  
—2 to 4

## OPHTHALMOLOGICAL CLINICS

COMMITTEE WM H. WILDER, Chairman, EDWARD V. L. BROWN and CASSIUS WESTCOTT

*Monday, November 10th*

WILLIS O'NANCE—Illinois Charitable Eye & Ear  
Infirmiry—2 to 30  
G. W. MAHONY—Polyclinic Hospital—9  
W. FRANK COLEMAN—Post Graduate Hospital—4  
WILLIAM H. WILDER—Rush Medical College—  
2 to 30

*Tuesday, November 11th*

CHARLES H. BEARD—Illinois Charitable Eye & Ear  
Infirmiry—2 to 40

CHARLES H. FRANCIS—Polyclinic Hospital—9  
GEORGE F. SUKFR—Post Graduate Hospital—9

*Wednesday, November 12th*

J. B. LORING—College of P and S—3  
OSCAR DODD—Illinois Charitable Eye & Ear In-  
firmiry—2 to 30  
S. MEAD HAGER—Polyclinic Hospital—9  
W. FRANK COLEMAN—Post Graduate Hospital—9  
GEORGE F. SUKFR—Post Graduate Hospital—2

*Thursday, November 13th*

WM. H. WIDMER—Illinois Charitable Eye & Ear Hospital—2 to 3  
G. W. MATHONEY—Polclinic Hospital—9

*Friday, November 14th*

H. W. WOODRUFF—Illinois Charitable Eye & Ear Hospital—2 to 3  
CHARLES H. FRANCIS—Polclinic Hospital—9  
W. FRANK COLEMAN—Post Graduate Hospital—4

*Saturday, November 15th*

L. A. L. BROWN—Illinois Charitable Eye & Ear Hospital—2 to 3

S. MEAD HAGER—Polclinic Hospital—9  
GEORGE L. SICKER—Post Graduate Hospital—2

*Days and Hours to be Announced Later*

C. GURNEE FELLOWS—Hahnemann Hospital  
RICHARD J. EVANS—Mercy Hospital  
MORTIMER FRANK—Michael Reese Hospital  
J. E. SNYDER—Michael Reese Hospital  
BROWN PUSEY—Northwestern University and Weir Hospital  
CASLEY A. WOOD—St. Luke's Hospital  
FRANK ALPERT—St. Luke's Hospital  
CASSIUS D. WISCOFF—St. Luke's Hospital  
WM. L. GAMBLE—University Hospital

## LARYNGOLOGICAL AND RHINOLOGICAL CLINICS

COMMITTEE: FREDERICK MENCY, Chairman, WM. F. BALLINGER and JOHN EDWIN KIDDER

*Monday, November 10th*

STANTON A. FRIEDBERG—Cook County Hospital—2 to 4  
CHARLES M. ROBERTSON—Polclinic Hospital—2 to 3 to 5

*Tuesday, November 11th*

JOSEPH C. BECK—Cook County Hospital—4 to 6  
OTTO F. FRITZ—Polclinic Hospital—4 to 5  
CHARLES H. LONG—Post Graduate Hospital—8 to 12

*Wednesday, November 12th*

BURTON HASTEN—Hahnemann Hospital—afternoon  
OTTO J. STEIN—Post Graduate Hospital—2 to 3  
FRIEDRICK MENDEL—Weir Hospital—8 to 11

*Thursday, November 13th*

JOSEPH C. BECK—Cook County Hospital—4 to 6  
RICHARD H. BROWN—College of P. and S.—9 to 11

CHARLES M. ROBERTSON—Polclinic Hospital—2 to 3 to 5  
CHARLES H. LONG—Post Graduate Hospital—8 to 12

*Friday, November 14th*

STANTON A. FRIEDBERG—Cook County Hospital—2 to 4  
OTTO F. FRITZ—Polclinic Hospital—4 to 5  
WM. F. BALLINGER—College of P. and S.—10 to 12

*Saturday, November 15th*

JOSEPH C. BECK—Cook County Hospital—4 to 6  
CHARLES H. LONG—Post Graduate Hospital—8 to 12  
ARTHUR M. COWIN—Weir Hospital—8 to 9

*Days and Hours to be Announced Later*

FRANK E. BRAWLEY—St. Luke's Hospital  
MORTIMER FRANK—Michael Reese Hospital  
J. HOLLINGER—St. Elizabeth's Hospital  
GEORGE P. MARQUIS—St. Luke's Hospital  
JOHN T. RHODES—Presbyterian Hospital

## ORAL SURGICAL CLINICS

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*Days and Hours to be Announced Later*

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# SURGERY, GYNECOLOGY AND OBSTETRICS

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## ON THE INDICATIONS AND RESULTS OF THE EXCISION OF POSTERIOR SPINAL NERVE ROOTS IN MEN<sup>1</sup>

By PROF. OTFRIED FOERSTER, DRESDEN, GERMANY

THE first indication for the excision of the posterior spinal nerve roots is based upon the physiological function of the same, as conductors of the sensibility, and is formed by violent neuralgic pains, which defy other methods of relief. The first to recommend this operation for the relief of pain in a case of ascending neuritis was Dr. Dana of New York in September, 1888, and the operation was carried out by Robert Abbe in December, 1888. Some time before, Sir William H. Bennett of London had divided, in a case of severe sciatica, five posterior lumbar and sacral roots. Since then, this operation has been performed for the relief of pain in a great number of cases. If I sum up all those published until now and five personal cases operated by Kuttner, Tietze, Gottstein, and myself, they amount to 44 cases, as shown in Table I. Six died of the immediate effects of the operation and seven succumbed sooner or later to the progressing disease, only in one case was injury produced, namely Brown Séquard's spinal hemiplegia, which decreased later on.

As is shown by Table I, in 22 cases the cervical roots were cut, in eleven cases the thoracic, and in eleven cases the lumbar and sacral roots.

As to the cause of the pain, it was questionable in 15 cases of so-called plexus-neuralgia, the nature of which mostly cannot be recog-

nized with certainty. In a great number of these, amputations of the limbs and operations upon the peripheral nerves had already been performed.

Nerve injuries of traumatic origin were the cause in 5 cases, pain caused by athetosis in one, neuritis consequent on arteriosclerosis in 2, pain owing to herpetic neuritis in 2 cases, syphilitic radiculitis in 2, arachnitis in one case, cancer or sarcoma, either in the body or in the vicinity of the brachial plexus or in the vertebral column, in 7 cases, severe pain after phlebitis in one case; tuberculosis of the hand in one case; and, finally, lightning pains in 7 cases.

TABLE I

*Root resection for the relief of pain*

44 cases, 6 deaths. Cervical roots, 22 cases, thoracic roots, 11 cases, lumbar and sacral roots, 11 cases.

	Cases
Plexus neuralgia	15
Traumatic neuritis	5
Arteriosclerosis	2
Herpetic neuritis	2
Syphilitic radiculitis	2
Arachnitis	1
Cancer or sarcoma	7
Phlebitis	1
Tuberculosis	1
Athetosis	1
Tapes	7

Results: Successful, 12 cases, failures, 23 cases; result unknown, 3 cases.

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America, New York City, November 2, 1912.

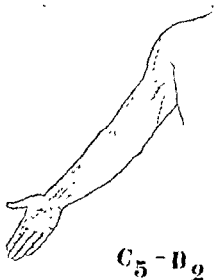


Fig 1

As to the results of the excision of the roots in all these cases of the 38 survivors, only 12 were considerably benefited, but we must say that the time of observation has been very short in some cases. In 22 cases there was very little or virtually no relief from pain, and in three cases the result has not been communicated. Among the successful cases, three are particularly striking because only one root has been divided namely in the case of Ballenge, the first thoracic, in the case of Chipault, the eighth cervical; and in the case of Horsley, the first sacral. Evidently only this single root was affected, which explains the lasting result. The failure is comprehensible in the cases of metastatic cancer of the vertebral column, since, owing to the progressing disease, other roots were subsequently attacked. In the majority of all cases the failure was due to not having excised enough roots. The more roots cut, the greater the continuous result, as, for instance, three cases in which the fifth to the eighth cervical and the first and second thoracic roots were divided. But in one case of Hildebrandt even this number of excised roots was insufficient. To account for this, we must consider that in the sensory supply of the arm, besides the fifth to eighth cervical and first and second

thoracic roots, the third and fourth cervical and the third thoracic roots take part too. If only the fifth to the eighth cervical and first and second thoracic are divided, the whole arm does not become anæsthetic. Fig. 1 shows the large area conserving sensibility. The area insensitive to pain is a little greater than that insensitive to light touch.

The relations of the leg are similar. In a case of syphilitic radiculitis, in which Kuttner and I divided all lumbar and sacral roots, violent pain recurred in the left leg. Fig. 2 shows the large area below the inguinal fold conserving sensibility and apparently supplied by the tenth, eleventh and twelfth thoracic roots.

In the arm as well as in the leg, all roots overlap each other. Until lately it was believed that a division of three adjoining roots was followed by an anæsthesia of some part of arm or leg, but it has been demonstrated by Clark and Taylor and by Hildebrandt that even the division of four or five adjacent lumbar roots produces no apparent disturbance of sensibility at all. I may add that resection of the fourth and fifth lumbar and the first and second sacral sometimes renders only a very little area on the tibia insensitive. There seems to be a difference in the disturbance of the sensibility if the upper roots are

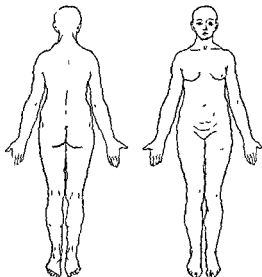


Fig 2

resected from the disturbance if the lower roots are divided.

A few words on the cases of tabes with severe lightning pains. Against this, as early as 1900, Mingazzini had suggested the resection of the posterior lumbar and sacral nerve roots, which, however, was performed only lately. I have collected seven cases, in one, cervical roots, in three, thoracic roots, and in three others, lumbar and sacral roots were cut. Two cases died, and only in one case, in which Enderlen resected the fifth to ninth thoracic for girdle pain, was a result obtained. All other cases were failures: the number of roots resected being far too little. Particularly important it seems to me, was a case of tabes in which Gottstein and I divided the fourth and fifth lumbar and first sacral. The patient had suffered from a terrible neuralgic pain, confined to a very small spot of the internal malleolus. We believed that this spot was only supplied by the three above mentioned roots. We cut them, and for a few days the pain ceased, but then it came back with old violence, not the slightest disturbance of sensibility had taken place.

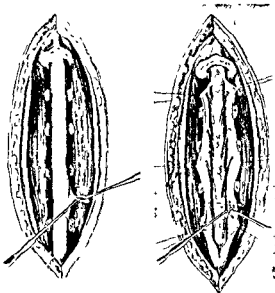


Fig 5

Fig 6

All these quoted cases clearly prove that for a continuous relief of pain we must cut in any case a great number of roots, when the arm is the seat of pain, the third to the eighth cervical and the first, second and third thoracic roots, when the leg, the tenth to twelfth thoracic and all five lumbar and all five sacral roots, when the thoracic region, a corresponding number of thoracic roots, must be divided. Exceptions are only those cases where a localized affection of one or a few single roots can with certainty be stated.

#### THE SECOND INDICATION

The second indication for resection of posterior spinal nerve roots is the visceral, especially the gastric, crises in tabes. It is a question here of thoracic roots. The visceral crises are produced by an irritation of the sensory sympathetic fibers of the abdominal organs, passing through the posterior thoracic roots. This irritation is indicated by the dreaded violent pains, the hyperæsthesia of the abdominal skin, and the increased abdominal reflex, vomiting and hypersecretion are only a secondary consequence of the sensory irritation. Supposing this point of view to be correct, the crises would cease after the



Fig 3



Fig 4



Fig 7



Fig 8



Fig 9



Fig 10

division of the corresponding posterior thoracic roots

This operation has been performed now in 64 cases, six of them succumbed, as shown in Table II, and four others died some weeks or months later in consequence of a pyelitis

TABLE II

*Root resection for the relief of gastric crises*

Total number of cases	64
Survivors	58
Successful	56
Failures	2
Deaths	6
Number showing no relapse	29
Number showing considerable improvement	18
Number showing small improvement	9

Among the 58 survivors, 56 cases were successful, and only two were failures from the beginning. Among the 56 successful cases, no relapse has been reported in 29, but we must bear in mind that the time of observation in a number of these has not been reported, and in several was short. But there exist also numerous cases in which no relapse has occurred, even after several years. Thus, a case operated by Kuttner, which had been in a perpetual critical state for years and had already undergone on this account several abdominal operations, has been cured now for four years. Another case, operated by Angerer, was observed for 18 months, and gained 48 pounds in weight. In a second case of Angerer, and also one of Moskowitz, the time of observation was over one year; in a second case of Moskowitz, two and one half years.

In 18 cases the crises relapsed, but nevertheless a considerable improvement was obtained, the critical state not having returned and the crises occurring very seldom and with only moderate intensity. The patients have gained considerably in weight, and a number



Fig 11  
Fig 14

Fig 13

Fig 15  
Fig 16



Fig 12



Fig 17



Fig 18





Fig. 19

have recovered their activity and their capability for work. In one case of Tietze the patient has for the past three years resumed his vocation as architect. The tabetic operated by Sauerbruch, two patients of Guleke, one of Zinn, and one of Lotheisen, have all taken up their calling again as workmen, mason and commercial travelers. In 6 cases the improvement was not great in 3 only slight, and the last two failed completely.



Fig. 20



Fig. 21

As to the cause of the more or less imperfect results, the root resection was not radical in a number of cases. The roots are often difficult to recognize and isolate from the spinal cord, owing to the concomitant arachnitis. Whether the resection has been radical or not is ascertained by the degree and extent of the insensitive area following the operation. Originally I had suggested for gastric crises resection of the seventh to tenth thoracic roots, later on I strictly exacted a more extensive resection. After the radical resection of the sixth to tenth thoracic the insensitive area reaches from the mammilla to the navel, as shown by Fig. 3. In lesser or greater resections it is correspondingly extensive. The area insensible to pain is a little greater than that insensible to touch.



Fig. 22.



Fig. 23



Fig. 24



Fig. 25



Fig. 26



Fig. 27



Fig. 29



Fig. 28.



Fig. 30



Fig. 31

What about this test in the single cases operated? Unfortunately, in 25 cases not a word has been stated about this. In 12, it can be proved that the resection was not radical as taught by the degree and extent of anaesthesia. I quote only one instance of this; namely, a case of Kuttner's, the isolation of the roots being nearly impossible and a part of them not pointed out.

Fig. 4 shows the following disturbance of sensibility on the left side, an area having conserved its feeling and being the seat of enormous pain. The crises, however, were removed. In a second operation we extirpated the spinal ganglia appertaining to the missed roots. The pain disappeared and the loss of sensibility became complete.

The second cause for relapse is allied to the nature of the gastric crises themselves. In a certain number of cases, in which the crises are removed completely, intestinal pains

occur sooner or later after the operation; sometimes they are transient, sometimes more lasting. The pains are caused by an affection of the roots above and below those resected, they probably often being irritated by the blood flowing during the operation into the net of the arachnoidea. If this irritation is more pronounced, real gastric crises may return.

The system of roots carrying the sensory sympathetic nerve fibres of gastro-intestinal origin is very extensive, it exceeds surely the seventh to tenth thoracic, and probably the fifth and sixth, as well as the eleventh and twelfth and the first and second lumbar roots are still concerned. Within this province, these now will be the source of the crises. In many cases, the affection of just the seventh

to ninth or the tenth thoracic seems to have been the origin of the crises; in other cases, surely other roots participated. A case of Guleke is very interesting in this respect. At first the seventh to ninth thoracic were resected. The crises ceased, but returned later on; then the tenth and eleventh were cut, and the crises disappeared again. Never knowing exactly which roots are especially affected and causing the crises, we have to resect as many thoracic roots as possible. The excision of the whole system, from the fifth thoracic to the second lumbar, will hardly ever take place; but seven roots should, if possible, be cut. The extent of the hyperaesthesia of the skin and the exact seat of the pain may serve as a criterion, whether the upper or the lower part be chosen.

Bearing in mind the great extension of such resection, we are obliged to be cautious, and to operate only in severe cases resisting every other treatment. In order to simplify the operation, Guleke has suggested not opening the dura and resecting the roots close to the spinal cord, as is usually done and shown by Fig. 5, but picking up and cutting the roots in their course outside the dura, where the anterior and the posterior roots are both enclosed in separate sheaths, as shown by Fig. 6. Franke has proposed, instead of *resecting* the roots, that, after exposing the corresponding intercostal nerve, the spinal nerves be *twisted out* with the ganglion. He has applied this modification three times, twice successfully, the third case died. Leriche had success too; Clairmont reports two complete failures. This proceeding of Franke's is exclusively a technical modification, and is subject to the same consideration as the original proceeding of root resection.

One last point must be considered with respect to gastric crises. Not all crises proceed from an irritation of the sensory sympathetic fibers passing through the posterior thoracic roots, but sometimes from the pneumogastric nerve. This nerve also carries sensory fibers of the abdominal organs. I have proved this in cases of complete section of the spinal cord in the upper thoracic or the cervical region. The crises originated by irritation of the sensory pneumogastric nerve

fibers show no pain, but a very pronounced nausea. Exner has divided the pneumogastric just below the diaphragm, and has performed this four times; one case died, and three were successful. Ranzi reports three cases — two successful, one not; and Kuttner reports a complete failure.

The division of the pneumogastric nerve below the diaphragm does not remove the irritation of the sensory fibers of this nerve, which is situated either in the jugular ganglion or between this and the medulla oblongata. Here the operation has to take place. But the vagotomy does remove the hypersecretion of the stomach, the vagus being its most important secretory nerve. This explains the results of Exner's operation.

#### THE THIRD INDICATION

The third indication for resection of posterior roots is spasticity and spastic paralysis due to a disease of the corticospinal path, especially the pyramidal tract. I will not here recur to the physiological point of view and the pathologico-anatomical facts which have led me to propose the resection of posterior roots for the relief of spasticity. But I cannot forbear mentioning that as early as 1904, Munro, as I have learned lately, cited Little's disease and spastic palsy as indicating division of posterior roots, without entering into a more detailed analysis. I first give a review of the cases hitherto operated, and shown in the following table.

TABLE III

*Root resection for the relief of spasticity*

159 cases, 14 deaths
88 cases congenital spastic paraplegia
3 cases hydrocephalus.
8 cases infantile spastic paraplegia.
4 cases traumatic spinal spastic paraplegia
1 case tumor of the spinal cord.
1 case Potts' disease.
6 cases syphilitic spinal spastic paraplegia.
11 cases disseminated sclerosis.
23 cases spastic arm paralysis.

I have collected 159; 14 died, thus making a mortality of 8.8 per cent. The mortality appears still less when considering the results of a single operator like Kuttner, who had only 2 deaths among 31 cases op-

erated for spasticity. Both were children with severe epilepsy; an epileptic attack followed the first stage of the operation. Since other authors relate the same cause of death, I am inclined to exclude from operation cases of spastic paralysis with frequent epileptic fits. Lisselsberg had no deaths among 12 cases. I counted 88 cases of congenital spastic paralysis treated by resection of posterior lumbar and sacral roots, with 6 deaths. In a large majority the results have been satisfactory, part even excellent. The causes of failure will be discussed later on.

I should like to demonstrate to you, in pictures, the extent of the improvement in some cases operated by Küttner and treated by me.

**CASE 1.** Boy, age 7. Severe rigidity of the limbs (Fig. 7), unable to make the slightest voluntary movement — to sit, stand, or walk, the patient lay in bed like a log. Preliminary orthopedic treatment, consisting in tenotomy of the Achilles and adductor tendons, had been absolutely of no avail. In consequence the legs were now held in extreme abduction (Fig. 8), with the same rigidity as they had previously been held in adduction. The result of the operation of root division was immediate cessation of the spasms and the return of voluntary motility. The boy moves his legs freely, he even lifts one leg without any assistance (Fig. 9) he can stand erect with straight knees unaided (Fig. 10), and walks quickly and safely on two crutches without any help. The improvement was maintained under suitable exercises, and is still going on. Time of observation, over four years.

**CASE 2.** Boy, age 11. Severe rigidity, was able to carry out slight voluntary movements of the legs, but could only bend both legs a little at the same time (Fig. 11), considerable subsidiary movements being carried out with the arms and head. The patient was quite unable to stand (Fig. 12) or to walk, and could not sit up even when assisted (Fig. 13), the resistance of the extensors of the pelvis being insurmountable. Since the operation the rigidity has quite disappeared, voluntary movements of the legs are carried out freely, the patient being able to bend each leg by itself (Fig. 14), to lift it up high (Fig. 15) without also bending the knee and ankle joint; he sits up alone (Fig. 16), stands (Fig. 17), and walks alone with long strides (Fig. 18).

**CASE 3.** Boy, age 10, with severe rigidity of the limbs and contraction of the flexors (Fig. 19). Motility as in the previous case, the patient was unable to sit, stand or walk (Fig. 20). After the operation the spasticity quite disappeared and perfectly free motility was obtained, the patient being able to bend each leg independently or to lift it high up (Fig. 21), and to abduct the legs widely (Fig. 22),

the patient stands alone (Fig. 23), and he walks alone with long steps (Fig. 24); he bends the leg well in walking (Fig. 25) and steps well forward (Fig. 26), mounts stairs without fatigue, and is out alone in the open air for many hours.

**CASE 4.** Severe spastic paralysis of all four limbs (Fig. 27). The patient was totally unable to carry out any voluntary movement; he lay in bed huddled up (Fig. 28), and in addition suffered from athetosis. Arms and legs were inextricably interlocked, as it were, in a tangle. Root resection was carried out here both in the lumbosacral and the cervical part of the cord. The spasms were greatly improved, the patient can now lift up each leg separately (Fig. 29), in standing (Fig. 30) and walking he has still to be supported on both sides, but he walks in this way with long steps. The patient voluntarily lifts each arm up high (Fig. 31) and can use his hands in eating and drinking.

Hevesy, too, has reported particularly good results, and Goldenberg has demonstrated, at the last congress of German surgeons at Berlin, a case who before the operation could hardly stand and scarcely move, and one year afterward traveled alone from Nurnberg to Berlin, to show himself to the congress.

I next quote 3 cases of hydrocephalus with spastic paraplegia; 2 died and one was greatly benefited. Hydrocephalus is a delicate condition for any operation upon the nervous system.

Next we find 8 cases of spastic paraplegia as the consequence of infantile encephalitis, all more or less successful.

I come now to the cases of spastic paralysis in spinal diseases. There were 4 of traumatic origin, 2 were successful, 2 not. One case of spastic paraplegia was due to a tumor of the spinal cord, the tumor had previously been removed some time before the root resection. No particular result.

In one case of Potts' disease, stationary for a long time, good result.

Six cases of syphilitic myelitis all were successful, although in one case the syphilis progressed later on, causing renewed paralysis. Among 11 cases of disseminated sclerosis, 4 died, 4 obtained a favorable result, and 3 no success. The sclerosis progressed rapidly after the operation.

In 23 cases of spastic paralysis of the arm treated by resection of posterior cervical roots, 2 died; in the majority the result was not good, a satisfactory improvement being

obtained in only a few cases, since the spasticity was not accompanied by any great paralysis. I refer to the case already demonstrated.

Besides, for real spasticity and spastic paralysis, the resection of posterior roots has been recommended also for some other motor disturbances differing from the former; at first the athetosis. As early as 1905, Spiller had suggested this, and during these last years it has been performed 13 times. The results were mostly bad, in a number the athetosis being even increased. No wonder, for in athetosis the muscular spasms are not due to an increased afflux of sensory stimuli to the gray matter of the spinal cord, but to an increased afflux of motor impulses, proceeding from the middle brain and carried by motor paths to the anterior spinal horns. Resection of posterior roots in athetosis is justified only when a real spasticity, as the consequence of injury to the pyramidal tract, exists besides the athetosis, which is sometimes the case.

Finally, I mention that Leriche has divided some posterior cervical roots in a case of Parkinson's disease, with, as he says, a satisfactory result. After this review of cases, I have to enumerate the single indications and contraindications for the resection of posterior roots in spastic paralysis. First, the morbid process must be stationary, or progressing very slowly. Therefore the majority of cases of disseminated sclerosis must be excepted. Syphilitic affection of the brain or spinal cord ought to be operated only after an energetic specific treatment, and must be subject to such afterwards. Under such circumstances the prognosis seems to be good. In spastic paralysis through tumor, the latter has to be previously removed, in Potts' disease, the bone process must be cured first.

Secondly, we must bear in mind that the resection of the posterior roots relieves only the spastic symptoms, but not the paralysis, if such exists besides the spastic state. A certain residue of the innervating pyramidal fibres must be conserved, or else the spastic paralysis is transformed only into a flaccid one through the root resection. Failure in a great many cases is thus explained, especially

in cases of spastic arm paralysis in hemiplegia. In spite of the removal of spasticity, many muscles necessary for the use of the hand remain paralyzed. On the other hand, in cases of complete spastic paralysis of the legs often a great number of innervating pyramidal fibers are conserved; but the voluntary excitability of the muscles cannot be demonstrated, being checked completely by the insurmountable spasms. Root resection in such cases produces a striking voluntary mobility. How shall we recognize, in face of cases of complete spastic paraplegia, whether all innervating fibers are destroyed or not? Goldscheider has suggested intradural injection of stovain, which puts the posterior roots for some time out of function; spasticity disappears, and now it remains to be seen whether movements are possible. Generally, we may say that in cerebral spastic paraplegia more chance exists for a number of innervating fibers being conserved than in spinal spastic paraplegia.

Thirdly, after the root resection and the return of voluntary mobility, a long and very careful exercise treatment is necessary, by which alone locomotion is gradually gained. For this a certain degree of intelligence is indispensable. Cases with idiocy are unsuitable. Also, in cases in which the patient cannot stay in the hospital a time after the operation, for exterior reasons, or in which want of care for the exercises on the part of the parents is to be feared, operation would better be omitted.

I pass over the orthopedic treatment often necessary after the root resection.

Fourthly, the disappearance of the spasticity after the root resection, taking place with the certainty of experiment, is the best proof of the sensory origin of the spastic contracture. But a certain degree of spasms sometimes returns, owing to the fact that the spinal gray matter is gradually recharged by the remaining posterior roots. Especially the arm is subject to such a return of spasticity, another reason for arm paralysis not being very suitable for root resection. In every case it is absolutely necessary that as many roots as possible be resected. For severe spastic paraplegia I recommend resect-

ing at least five roots. It is necessary to leave the fourth lumbar root, since this root generally guarantees the extensor reflex of the knee so very necessary for standing and walking. Thus the general rule is resection of the second, third and fifth lumbar and first and second sacral roots. Unfortunately, there exist individual differences; in some cases, the fourth lumbar does not affect knee extension but knee flexion, as the fifth lumbar and first sacral do; the knee extension is affected only by the second and third lumbar roots. In such cases, the above mentioned resection of the second and third lumbar, etc., is wrong; the third lumbar must be left, instead of which the fourth can be resected. In order to know by which lumbar roots the extensor reflex of the knee is effected, we must have recourse to the electric current during the operation. I use it now in all cases. Table IV shows the results of stimulation of the different roots in the generality of cases, but in a minority the results differ, as I have already shown. The electric stimulation affords also the advantage of making a sure distinction between the anterior and the

posterior root possible, the former reacting to the current with a motor effect, the latter not.

TABLE IV

*Effects of electric stimulation of the lumbar and sacral roots*

II	Sacral	Plantar flexion of toes. Plantar flexion of foot.
I	Sacral	Plantar flexion of foot Flexion of knee.
V	Lumbar	Flexion of knee Extension of hip.
IV	Lumbar	Dorsal flexion of foot Outside rotation of hip. Extension of knee.
III	Lumbar	Flexion of knee Knee extension.
II	Lumbar	Adduction of hip Knee extension Adduction of hip.
I	Lumbar	Flexion of hip. Flexion of hip

For the arm, it is advisable to resect either all roots from the fourth cervical, to the second thoracic root, except the sixth cervical; or to resect from every single root, including the sixth cervical, the majority of the fascicles composing each root.

## DISCUSSION BY DR. ALBERT BAUER, Breslau, Germany

I SHOULD like to speak a few words on the surgical technique which in the resection of roots has been constantly followed at Professor Kuttner's clinic in Breslau. Kuttner has performed this operation in 39 cases altogether, once for pain in a case of syphilitic radiculitis, already mentioned by Prof. Foerster; 7 cases for gastric crises. One of them died, during the operation he was attacked by a respiratory paralysis, and had to be put on his back, the dura was opened in order to produce artificial respiration. He died of meningitis. Kuttner has operated 31 cases for the relief of spasticity, 2 of these, both children, died in an epileptic attack after the first stage of the operation. Therefore Kuttner now excludes epileptic cases from the radicotomy. The 3 deaths among the 39 cases make a mortality of only

7½ per cent. Kuttner champions the performing of the operation in two stages. He is convinced that tabetic patients, suffering from gastric crises, are all more or less weakened by the disease and the great doses of morphia they take, and would not resist the long operation at once, it producing a considerable shock to the whole nervous system and acting intensely upon the heart and respiration. The case of gastric crisis which he lost was operated in one stage; the respiratory paralysis took place only toward the end of the root resection. Had it been done in two stages, all would have gone well.

Kuttner also operated spastic paralysis in two stages. The majority of the patients, particularly adults, have less power of resistance. Added to this, for recognizing

and isolating the right roots the field of operation must be free of blood, which is scarcely the case in freshly opened vertebral arches, though it is indeed some days later. The danger of infection to be risked by performing in two stages is imaginary. Not a single case has had an infection. Kuttner performs the laminectomy always with simple Luer tongs; he resects definitely, not temporarily, the vertebral arches. He proceeds according to the original method, picking up and resecting the roots, at the point where they perforate the dura.

It has been recommended by several

authors to resect the roots on the point where they issue from the lumbar enlargement of the spinal cord, as at this point they lie much closer together and therefore demand a far less extensive laminectomy.

We reject this proceeding, as it renders it impossible to distinguish the different roots. The few cases thus operated are not very promising.

Last of all, your attention is called to five cases in which he has performed the root resection both in the cervical as well as in the lumbosacral region. All these patients were suffering from spastic diplegia.

## THE SURGERY OF SPINAL CORD TUMORS FROM A NEUROLOGIC VIEWPOINT<sup>1</sup>

By DORSY HECHT, M D, CHICAGO

Associate Professor of Nervous and Mental Diseases Northwestern University Medical School, Neurologist to the Michael Reese and Wesley Hospitals

THERE is much warrant for the belief that individualistic effort, however competent, is seldom equal to the tasks imposed upon it in the solution of many of the recent clinical problems in the field of neurology.

Surely the need for and the desirability of a joint kind of study and service on the part of the neurologist and surgeon have been abundantly testified to in the last quarter century, that is, since 1887, when the successfully operated and completely recovered Horsley-Gowers case was consigned to its place of first and historic importance in the surgery of spinal cord tumors.

The excellence of much of this co-operative work done, let us say, in the past two decades has had a twofold effect—the development of greater diagnostic acumen in the neurologist and the occasional conversion of a general surgeon into a neurosurgical specialist whose neurologic attainment inspires quite as much confidence as does his surgical skill and is held in the same high regard.

The time and energy, however, devoted to the surgery of the skull and brain have hither-

to been immensely disproportionate to that expended in behalf of the spine and cord, probably because of the much more frequent occurrence of cerebral tumor.

This uneven division of labor is unfortunate and its continuance to be deprecated, since the guiding and determining factor in any form of therapeutic intervention should be not so much the frequency-incidence of a lesion, but the prospect of relief or promise of recovery—in short, the prognosis.

A review of the literature tends to show that the cord is at no disadvantage when compared with the brain as the object of surgical attack. In fact, both decompressive and radical measures applied to the spinal cord and its dural and bony envelope, when in entirely competent hands, are attended with more gratifying results than may be claimed for the same surgical procedures applicable to the brain under identically favorable conditions.

Statistics variously compiled in the past twenty years seem to indicate that one half of all intraspinal tumors are operable, and of these, one half are much benefited and not

<sup>1</sup> Read before the Clinical Congress of Surgeons of North America, New York City, November 12, 1912.



autopsy notes point to brain involvement, the theory of an internal hydrocephalus has been advanced, caused by an occlusion of the spinal subdural space at the site of the tumor. Heubner reports the occurrence in a child of seven of an internal hydrocephalus complicating a glioma of the cord.

Edema of the lower extremities, as a vasomotor phenomenon occurring chiefly in the lumbosacral and caudal tumors, has been observed by Bailey (10), in whose case it resembled the swelling due to renal disease, but the urine was normal.

3. One cannot read the papers of Spiller (11), Horsley (12), Krause (13), Oppenheim (14), Weisenburg (15), Mills (16) and Munro (17) on circumscribed spinal meningitis without feeling that many hitherto imperfectly understood chronic cord conditions are now made more intelligible to the clinician, more easily grouped, and therefore more promising in the surgical sense. The chief clinical attribute of this newly recognized entity is its close mimicry of cord tumor, and in this connection, without going into pathological detail, I desire to emphasize its importance. According to some writers it is rare, and yet it is certainly not so rare as not to be, in the opinion of Horsley at least, more common even than tumor.

The largest clinical contribution to the subject of circumscribed meningitis is that of Horsley (12), who from his series of 21 cases has drawn conclusions that ultimately may make the line of differentiation between intradural tumors and subdural cyst accumulation more sharp than it now is. The causal factors are not clear, and the diagnosis would, in the main, seem to depend upon a slower onset and a greater diffuseness of all the symptoms and signs of the disease. Horsley, for instance, emphasizes that tumor pain is more restricted to the distribution of a single root, whereas in this form of meningitis it is more diffuse, involving an entire extremity—that the weakness and wasting also tend to be widespread and embrace a whole limb. He holds that the same is true of disturbed sensation, which is more likely to affect an entire extremity and show hyperæsthesia in contrast to which tumor more often presents

varying degrees of anæsthesia. Although Horsley attaches much weight to this diffuse hypersensibility and the absence of focal anæsthesia in all of his cases, Weisenburg (15), in his strictly circumscribed cyst, calls attention to the levels of sharply defined anæsthesia for touch, pain and temperature and their almost daily vacillation. This case more than others seems to justify the contention that a true cyst formation may exist and as such is to be differentiated at least pathologically from the Horsley type. The vasomotor symptoms occasionally found in tumor, Horsley has never observed in chronic meningitis, whereas in the Weisenburg case, the right thigh was swollen and the skin of the inner parts of both large toes was tinged a bluish red. Contrasting observations such as these may or may not at the present time clarify the clinical picture, but they certainly show a determination to arrive, if possible, at a preoperative diagnosis of circumscribed serous meningitis. I am not prepared to say that intrinsically there is any difference between the Spiller-Weisenburg conception of an idiopathic collection of clear fluid in a cyst of the spinal pia-arachnoid and the Horsley view of a chronic spinal meningitis. I am, however, disposed to believe that in either condition, a decompressive laminectomy is indicated, that the release of fluid under tension should promptly relieve the symptoms, and if we may believe the statistics, will result in an ever increasing percentage of partial and even complete permanent cures.

4. A critical survey of Stursberg's (1) many citations in tabulated form makes it plain that surgical flaws have been quite as common as neurologic flukes in the cord tumor problem. It is not pertinent to the caption of this paper to discuss these. Only in so far as they affect the prognosis are the nature and extent of the surgical procedures of interest to the neurologist. The timeworn contentions held in regard to the employment of large versus small incisions in general surgery obtrude themselves in this special field, and we find one operator advocating the resection of many spinous processes and the making of a large opening into the canal, while another

SUMMARY OF THE RESULTS OF OPERATIVE TREATMENT IN HITHERTO REPORTED CASES.  
STURSBURG'S (1) TABULATION

	Tumors and extra-dural neoplasms except those starting from the base or passing over it							Neoplasms starting from the base or passing over it							Total of observations						
	Favorably influenced	Permanently cured or considerably improved	Died		Not influenced	Uncertain notes	Total of observations	Favorably influenced	Permanently cured or considerably improved	Died		Not influenced	Uncertain notes	Total of observations	Favorably influenced	Permanently cured or considerably improved	Died		Not influenced	Uncertain notes	Total of observations
			Soon after operation or from its effects	Independent of operation						Soon after operation or from its effects	Independent of operation						Soon after operation or from its effects	Independent of operation			
Cervical spinal cord	70 47.6%	9 5.8%	8 5.0%	2		1	21	15 71.4%		3 14.3%	1 4.8%			4	31 44.0%	10 10.0%	10 10.0%	3		1	25
Dorsal portion of spinal cord	18 40.9%	8 17.8%	15 33.3%	9	5 11.1%	1	57	6 10.5%	13 22.7%	3 5.1%	3 5.1%			11	34 50.0%	20 28.6%	15 21.4%	13	4 5.6%	1	68
Lumbar portion of spinal cord	22 61.1%	3 8.3%	4 11.1%	3			15	7 46.7%	3 19.4%			2 13.3%		7	17 64.0%	10 38.5%	4 15.4%	3	1 3.8%		25
Location not indicated	40 51.0%	20 25.0%	15 18.8%	14	3 3.8%	2	66	11 16.7%	3 4.5%	4 6.1%	4 6.1%			22	31 47.0%	22 33.3%	11 16.7%	15	4 6.1%	2	119

favors hemilaminectomy, with a saving of spines and a smaller entrance to the canal. Here, as in all surgical work, the end justifies the means, and if it requires a large exposure to gain easy access to the field of operation, it seems to me unwise to limit it especially when the subsequent protection to the cord is not seriously impaired. Again, the larger opening seems desirable when one realizes what great refinement in technique is essential to success. I am not sure that palpation through an intact dura is reliable in determining the presence of the tumor. Cases are recorded where it has eluded the feel of the palpating finger. With the exposure of the cord proper and the confirmation of the diagnosis, the active participation of the neurologist in the surgical aspect of the tumor problem is likely to cease, for after all questions of technique, mortality from hemorrhage, loss of cerebro-spinal fluid and infection rest more largely with the surgeon. It seems to me that the high point in neurologic responsibility is reached when the diagnosis is established and the indications are drawn for the proper kind of surgical intervention.

It is my personal belief that the ultimate results in both the decompressive and radical surgery of the spinal cord warrant the neurologist and surgeon in taking all the risks, particularly since fatality is inevitable in tumors where operation is either too long deferred or altogether discouraged and denied.

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a few entirely cured. Easily the best, most comprehensive and complete tabulation of spinal cord tumors and their operative treatment is that of Stursberg (1), who cites 126 cases, together with some 85 references. From this compilation we are permitted to infer that good recoveries are made in more than 30 per cent of cord tumor operations. Excellent as is this percentage, it no doubt can and will be improved upon when diagnostic error and therapeutic temporizing, on the one hand, and poor surgical judgment with faulty technique on the other, are reduced to a minimum.

The inquiry into spinal cord disease must be made to transcend issues of mere physiology and pathology and embrace the clinically more absorbing problems of injury and repair inevitably associated either with trauma or tumor.

If for the sake of the best achievement a conjoint effort is desirable, then it seems to me that the neurologic opportunity lies first of all in the direction of greater accuracy in the diagnosis. (1) the more exact differentiation from chronic spinal cord diseases; (2) a keener analysis of the less common, atypical symptoms, (3) a better understanding of the rôle of circumscribed serous meningitis and intraspinal cyst formations, and finally (4) the endorsement of early surgical intervention, in the sense of both the decompressive and radical operations.

To discuss in their turn some (by no means all) of these clinical phases in relation to spinal tumor, may not be altogether unprofitable.

1 I believe that the differential diagnosis between cord tumor and certain chronic spinal diseases, however refined, will always present some difficulties until more definite, let us say, cytologic criteria, come to have greater clinical significance. To this end, Kleiberger (2), in four cases of extramedullary cord tumor, analyzed the fluid taken by puncture at a point well below the tumor. This he found to be a deep yellow (xanthochromin) capable of very rapid coagulation and showing an increased cell count. Similar findings had previously been reported by Cestan and Ravaut (3). Reichmann also reports the cere-

brospinal fluid from an intramedullary tumor as being a pronounced yellow and possessed of rapid coagulating power. It is to be hoped that more ample confirmation from the cytologic side will be forthcoming.

I cannot subscribe to the view (4) that "the diagnosis of spinal tumor presents no difficulty and should be made very early; in fact, as soon as spinal symptoms are associated with intense persistent pain in one locality." If it were all so simple, there would seem to be little need of further development of the problem. In fact, any bony thickening of the vertebral bodies may so encroach upon the lumen of the canal as to cause compression on the cord. Instances in point have been reported by Bailey and Casamajor (5), who have shown how a spinal osteo-arthritis was capable of causing localized paralysis as a compression symptom, with complete relief afforded by laminectomy. This case, the writers tell us, "recalled a previous case in which the diagnosis of an extramedullary tumor had been made, in which the operation, followed though it was by relief of all symptoms, showed nothing but a bony thickening of the laminae."

In practically every case of paraplegia in which the causal relation to the onset of paralysis is vague or wholly obscure, the query as to the possible existence of cord tumor is justifiably raised. A case seen only recently and regarded by some clinicians with suspicion as tumor has proven to be disseminated sclerosis. Again, one learns that tumor may exist in the guise of multiple sclerosis, or that it may bear the closest clinical resemblance to spinal syphilis or syringomyelia, particularly to the latter, if it happens to be of intramedullary origin.

2 Errors in diagnosis, however, quite as unavoidable as they are costly, are made chiefly in the early stage of tumor growth, when the clinical picture is but slightly developed, when symptoms are not true to type and run a rather unusual course. I refer more particularly to the root pains, localized paralyses, the sensory disturbances and certain accessory vasomotor or trophic manifestations.

As concerns the pain element in cord tumor,

it is of a character which we have learned to associate with the spinal roots—severe, radiating, burning, cutting, fulgurant. In those cases where the meninges and intervertebral foraminal exits are extensively implicated, as in metastatic carcinoma, I believe they reach their maximum intensity and are agonizing beyond endurance. It is a mistake to think of these pains always as constant; whether unilateral or bilateral, they may fluctuate considerably from day to day or week to week, and even wholly disappear for longer periods of time. In this respect, they may be likened to the simple neuralgias. It is not an uncommon experience for the neurologist to observe a "sciatica," so-called, appearing first on one side and later affecting both, existing on and off for months or even a year or more, as the forerunner of a syndrome that predicates tumor. Clearly deceptive and therefore, worthy of record are the occasional instances where *pain is conspicuous by its absence*. Schultze (6), in 1907, reported two cases of absence of pain or even pressure tenderness over the vertebrae; in the one, a tumor about the size of a hazelnut was situated laterally on the cord, and in the other, a growth about 1.5 cm. in length grew from the right side. These cases alone suggest that persistent absence of pain should not necessarily prove a contraindication to laminectomy if other symptoms appear consistent with such a procedure. A small growth situated on the anterior aspect of the cord is the ready explanation for this anomaly. In one case of my own (to be published later) a diagnosis of cord tumor was too long deferred and the opportunity for relief wasted because the pain lacked the severity seemingly essential to a positive diagnosis.

The objective sensory disturbances that are known to have a definite localizing value in tumor diagnosis are segmentary in type. But here, again, in a certain percentage of cases, the clinical behavior is contrary to expectation and anæsthetic areas will often show great irregularity and indistinctness in outline. It is worthy of emphasis that the line of demarcation in the upper level of anæsthesia is never as definite as we observe it in traumatic compression, myelitis, or in

transverse myelitis of infectious origin. Experience has frequently shown that spinal tumors found at operation or necropsy lie considerably higher than the segmental sensory disturbances would indicate. The surgeon, therefore, may safely accept the dictum to go one or even two segment levels higher in exposing the field of operation and a like margin may be observed in establishing the lower point of exposure. Sensation may be affected in all its modes and tenses, but, on the whole, tactile sensibility is more disturbed than that for pain or temperature. Not infrequently, a typical syringomyelic sensory dissociation syndrome is present, and when this is the case it should not necessarily be construed as evidence of a centrally situated intramedullary growth. I recently observed this particular type of dissociation in a case of vertebral tubercular disease with marked cord compression. In this connection, the case of Bovaird and Schlapp (7) is particularly instructive. Therefore, I am inclined to Bailey's (8) view that sensory dissociation in the clinical picture need not offer a contraindication to operation.

I think we have a right to expect that some disturbance of sensation, most commonly of the tactile variety, will be present in all tumor cases. I should even say must be present, because, so far as I know (Bailey has also surveyed the literature on this point), it is not recorded that a positive diagnosis of spinal tumor has ever been made in the *complete absence of objective sensory disturbance*. The anæsthesia need not be complete—the slightest reduction has at times the greatest significance, but its detection requires, as I have had cause to learn, the most careful, painstaking examination.

As if to add to the difficulties of diagnosis, a few new and most extraordinary symptoms have from time to time found their way into the literature. They have occurred sufficiently often to seem more than a mere coincidence. For instance, Taylor and Collier (9) reported the presence of optic neuritis in twelve cases of lesions of the spinal cord, three of which were tumors of the cervical region. In such tumors, together with others of cervical origin, in which clinical and

# THE FIELD OF USEFULNESS OF THE CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA<sup>1</sup>

ADDRESS OF THE RETIRING PRESIDENT

By A. J. OCHSNER, M. D., CHICAGO

YOU have done me the great honor of electing me to the office of first President of your Congress, and I assure you that words fail to express my appreciation of this honor. New York, with its wonderful clinics and its famous clinical teachers, offers a fitting field for the labors of this Congress. No other city in the world has better teachers of clinical surgery than the present generation of surgeons in this city, and, judging from the preparations which have been made during the past twelve months, I am confident that we will have an immensely profitable week of clinical instruction, which cannot fail to result in human progress of high quality and lasting efficiency.

The keynote of all inspired activity of to-day is contained in the idea of service. All other conditions must retreat before this central, all-absorbing idea. The time when financial success, wealth or pomp, or distinction for valor in combat were foremost in the human mind is rapidly disappearing as past history.

Personal achievement that does not contain the element of service must soon be classed as undeserving of general admiration. Half a century ago a few great teachers and philosophers grasped this idea in its full meaning and impressed it upon their pupils. Every one of these has in a measure absorbed the spirit of the teaching that in order to be worth while education in all fields must include ethical development to a marked degree, and that education in the practical branches must mean not only the acquisition of the ability to do work successfully, but also the willingness to render service which is much more profitable to those who receive it than to him who gives it. This service benefits not only the individual, but to a much greater degree also the community.

This Congress is in the broadest sense an educational institution. If it simply served to enable those of us who have the good judgment to attend its meetings to improve our personal condition, I would look upon it as a dire failure. If, on the contrary, it serves to improve the quality of the service our profession gives to the people of this country, then we may look upon it as a successful institution and a worthy element in the progress of American civilization.

The first elements necessary to improve both the quantity and the quality of service are inspiration and enthusiasm. The meetings of this Congress have given inspiration which has lasted throughout the year with many of the participants.

Many important facts resulting from the enormous experience of the ablest clinicians of this and other countries have been carried by our members to all parts of this country.

In every large city there are famous clinics which can easily be found, but there are also among the younger workers who are relatively unknown those who are doing admirable work which is well worth the attention of the surgical profession. These men can demonstrate their work during the sessions of this Congress, and can establish their ability as clinical teachers and scientific workers and be judged by comparison. Thus the Congress serves as a training-school for teachers of clinical surgery, and will furnish an opportunity for natural selection by the survival of the fittest. Thus every clinical teacher has equal opportunities with all others to demonstrate his qualifications and his caliber. From the educational standpoint we have gained much. The Congress has already demonstrated the presence of most excellent clinics in many hospitals which had previously not been known to the surgeons of this country who are seeking clinical knowledge and

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America, New York City, November 21, 1913.

thus has increased greatly the efficiency of our resources for surgical education.

In each of the three cities visited by this Congress the surgeons have become more thoroughly organized for efficient teaching, and they have learned in this way to appreciate more fully each other's work. This is certain to eliminate provincialism and stimulate progress by mutual comparison.

To the practitioners of surgery it has given an opportunity to see the great surgeons of the country at work, which enables them to read the writings of these men with greater interest and profit. I dare say there is not a member present who will not increase the amount of his scientific reading because of his personal observation of the work done by the writers.

After all, the efficient surgeons of to-day, namely the surgeons who are best equipped for service in the broadest sense of the word, have acquired the most important part of their equipment after graduation from medical school.

It is not the man who had the best education before receiving his doctor's degree who is the greatest surgeon in wisdom, in learning, in efficiency, in practice, and in equipment to give human service. If we should select the ten men in this country who rank highest in the field of surgery measured by the above standards, not more than three or four would be men with university degrees before entering their medical colleges.

If we compare these men, who might be considered deficient from the educational standpoint, with an equal number of the greatest surgeons from all other parts of the world, they will stand out with distinction by such a comparison.

It is the man who has been inspired to work, and who constantly finds means for unflinching enthusiasm, and who continues his studies and frequently observes the clinical work of others, who ultimately becomes the most efficient surgeon and the man of greatest learning. These facts will not apply to the next generation of surgeons in this country, because better opportunities will be provided for undergraduate classes, but they obtain for our generation.

The Clinical Congress of Surgeons of North America is demonstrating its ability to organize the present surgical profession of this country into a body that will make for the development of the greatest possible efficiency in this field for human service.

While doing this it provides inspiration and educational opportunity which affects in a most advantageous way all members of our profession who are working for improvement. The organization contains to a high degree the means of advancing this exalted principle of service, and deserves to the fullest extent the splendid support it has received from so large a number of the strongest men in our profession.

## EXPERIMENTAL LIGATION OF THE PORTAL VEIN; ITS APPLICATION TO THE TREATMENT OF SUPPURATIVE PYLEPHLEBITIS<sup>1</sup>

By HAROLD NEUHOF, M. D., NEW YORK CITY

From the Pathological Laboratory of Professor Ludwig Pick, Krankenhaus Friedrichshain, Berlin

THE fact that no surgery of the portal vein has as yet developed appears to depend upon the results of animal experimental studies. Many observers have demonstrated that ligation of the portal vein regularly leads to death in a very short time—in half an hour to two hours. Their work will be discussed subsequently; it suf-

fices to state here that the human portal vein has been considered a *noli me tangere* as a result. Although the portal vein has been more or less completely ligated for accidental injury in a very few instances,<sup>2</sup> a deliberately planned ligation of the vein has never been practiced.

<sup>1</sup> *Brewer Ann Surg., Phila.*, 1908 xlvii, Hallopeau *Rev d'Chir.*, 1910 No 47.

<sup>2</sup> Read before the February meeting of the Surgical Section of the New York Academy of Medicine.

Were there no practical indication at present for a knowledge of the results of portal vein ligation, such information would be desirable for possible future application. I believe, however, that, of the diseases involving the portal vein, suppurative phlephlebitis is a condition requiring a knowledge of the results of portal vein ligation at the present time. With this in view, the literature on the subject of portal vein thrombosis and occlusion was examined and some experimental studies were made.

In 1856 Oré<sup>1</sup> demonstrated that ligation of the portal vein of rabbits resulted in death in a very short time. Schiff,<sup>2</sup> Claude Bernard,<sup>3</sup> and others determined that, following this procedure, dogs invariably die within three hours. The symptoms described as the result of portal vein ligation were progressive weakness, paresis of the posterior extremities, an inconstant lowering of temperature, accelerated respiration, coma, and death. Bernard believed that death was due to acute anæmia, the result of accumulation of blood in the portal vein and its tributaries. It was demonstrated by Tappeiner,<sup>4</sup> however, that more blood could be withdrawn from a dog without causing death than that accumulated in the portal district after the vein was ligated. Another hypothesis was that death resulted from suppression of the function of the liver (Schiff and others). It was subsequently found, however, that the blood from the heart proved no more toxic after portal vein ligation. Furthermore, prolonged life is possible after an Eck fistula has been established. Without entering into all the theories that have been advanced to explain the cause of death after ligation of the portal vein, it may be stated that none has received general acceptance.<sup>5</sup>

To determine if animals could live after any form of portal vein occlusion, it appeared desirable to attempt to ascertain the cause of

death after complete ligation. In several successive experiments (five in number) the portal vein was completely tied off. The following experiment is a typical one, and the satisfactory technique that was developed for the exposure of the portal vein of the dog will therein be described.<sup>6</sup>

*Experiment 3* September 13, 1912, 4 P. M. Large, powerful female dog. No preliminary dose of morphin. Ether anæsthesia. Curved incision starting near the lower end of the sternum, running parallel with the right free border of the ribs, and descending vertically for 5 cm. The upper part of the right rectus muscle divided transversely. The margin of the liver elevated, and the pyloric end of the stomach drawn downwards. The region of the portal vein thereby exposed, no further dissection being necessary. The vein itself sufficiently exposed by incising the thin layer of overlying peritoneum. Gently freed from the surrounding structures and readily ligated above the entrance of the gastrosplenic vein.

Vein tightly ligated. Operation completed at 4:25 P. M. Observations at end of operation: Animal evidently in poor condition. No signs of recovery from anæsthetic (although reaction had begun before the vein was ligated and very little anæsthesia was given thereafter). Pulse slow and very compressible. Respirations rapid (32 per minute), shallow, slightly irregular. Pupils do not react, although corneal reflexes are present. 4:40 P. M., animal remains unconscious. Abdomen markedly distended, tympanic. Respirations as before, no air-hunger, however. Pulse generally as before, occasionally irregular and rapid. Skin cool and slightly moist. Musculature completely relaxed. Death at 4:55 P. M., ushered in by slight, generalized convulsions. Although pupils did not react, corneal reflexes remained until the end.

*Post-mortem.* Small amount of bloody fluid in peritoneal cavity. Stomach moderately distended. Small intestines greatly distended and deeply cyanotic, the mesentery very oedematous. Some blood in intestinal lumen. Intestinal wall very oedematous and firm to touch, many larger and smaller scattered submucous hæmorrhages in small intestine. Spleen twice the normal size, plum colored, extensive subcapsular hæmorrhages. Remaining organs somewhat anæmic, otherwise negative.

The manifestations were approximately the same in all the experiments in which the portal vein was completely ligated. Death invariably occurs in from fifty minutes to an hour and a half after ligation, in a surprisingly

<sup>1</sup> *Ore Compt-rend hebdom des Séances de l'Acad. d. Sciences m.*

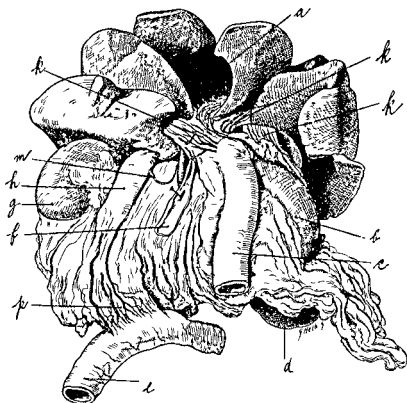
<sup>2</sup> Schiff *Zentralbl f d med Wissensch* Berl, 1863 No 8.

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<sup>4</sup> Tappeiner, *Ueber den Zustand des Blutstroms nach Unterbindung der Pfortader* Arb. a. d. physiol. Anst. zu Leipzig 1872.

<sup>5</sup> Nearly all the studies in portal vein ligation were made from thirty to sixty years ago. It is therefore not surprising that some theories then advanced to explain death now prove untenable. Modern notions concerning shock, for example, were not evolved until recent years.

<sup>6</sup> The literature contains no description of the technique and but scant information concerning post-mortem findings after portal vein ligation.



Drawing to show the collateral circulation after ligation of the portal vein (Experiment) (a) Cavity left in liver by removal of the gall bladder (b) Stomach (c) Duodenum (d) Spleen (e) Lowest part of small intestine (f) Portal vein slit open, arrow in gastrosplenic vein. Ligatures completely occluding the vein are seen higher up (g) Right kidney (h) Vena cava (i) Gastrohepatic omentum, containing numerous collateral vessels (j) Branch of vena cava accompanying the hepatic artery to liver (k) Small area of anastomosis between portal branches of lower ileum and branches of vena cava

uniform manner. Respiration becomes superficial and accelerated (up to forty-five a minute). Considerable abdominal distention develops. The pulse is generally slow and compressible. In those animals recovering consciousness pronounced weakness of the lower extremities is evident. Death is ushered in by generalized convulsions. Although the pupillary reaction does not usually return after the vein has been ligated, the corneal reflex remains active until a short time before death. Usually the animals do not recover from the anæsthetic (two of the dogs reacted from the ether for very brief periods), but sink into a comatose state from which they cannot be aroused. Post-mortem examination reveals moderate distention of

the stomach and enormous distention of the small intestines. The latter are deeply cyanotic, the intestinal wall is intensely œdematous and firm and shows numerous larger and smaller submucous hæmorrhages. The lumen contains some blood. The spleen is enlarged to two or three times the normal. It is very firm, its capsule tense, and there are extensive subcapsular hæmorrhages. The remaining viscera are somewhat anæmic but not blanched.

The clinical manifestations, the manner and time of death, and the post-mortem findings indicate that death following complete ligation of the portal vein is not due to acute anæmia or to intoxication. On the other hand, the intense acute engorgement of the



intestinal tract and the extreme intestinal distention have been found to be the cause of death both in the human being and in animal experimentation carried out for various purposes. Without retracing the steps whereby the present view has been reached, one may state that it is now generally held that death in such instances is due to shock. Analogously, therefore, death from complete ligation of the portal vein is also due to shock.

When death was found to follow so promptly upon portal vein ligation, the question that arose was whether ligations at different levels would also prove fatal. In 1900 Kusnetzow<sup>1</sup> reported that ligation of the portal vein below the entrance of the gastrosplenic is fatal, but that dogs may live if the portal is occluded above the gastrosplenic vein. His work has not been confirmed by subsequent experiments, including those of Ito and Omi<sup>2</sup> and of mine. The following example illustrates the results I have obtained:

*Experiment 6* September 17, 1912, 4.30 P M. Good-sized lively mongrel. Preliminary dose of morphin. Ether anesthesia. Previously described incision and exposure of portal vein. Simple dissection displayed the entrance of the gastrosplenic into the portal. Latter ligated 1 cm. below the point of entrance. 5 P M., operation concluded and vein has been occluded for ten minutes. Deep unconsciousness, shallow and rapid respiration, pulse not accelerated, pupils do not react. 5.15 P M., no recovery from anesthetic. Abdomen considerably distended and tympanitic. Corneal reflexes remain, pharyngeal and other usual reflexes absent. Slight generalized twitchings. 5.35 P M., involuntary defecation, blood-stained. Generalized convulsions, death.

The post mortem findings correspond with those above described.

It was first demonstrated by Solowieff<sup>3</sup> that dogs could survive occlusion of the portal vein if the branches were ligated at different times. He ligated the superior mesenteric vein at the first operation, the gastrosplenic vein a few days later, and finally the portal vein above the gastrosplenic. Some of the animals lived weeks and even months after operation. Two subsequent observers did not confirm Solowieff's results in the single experi-

ment that they report.<sup>4</sup> As the result of their work they conclude that dogs may live if the branches of the portal vein are ligated at different operations. If, then, the portal vein is ligated above the gastrosplenic, death results, but less promptly than when preliminary ligation of the branches has not been practiced. I repeated Solowieff's experiments with modified technique and could confirm his results, as demonstrated in the following:

*Experiment 8* September 24, 1912. Brown and white dog, weight 8520 gm. Ether anesthesia, with preliminary dose of morphin. Low vertical incision immediately to right of median line. The inferior mesenteric vein readily found and ligated close to the portal trunk. Careful suture of abdominal wall. Animal recovered promptly and was quite well next day. Weight remained unchanged.

September 28, narcosis as before. Right-sided incision higher up. The superior mesenteric vein ligated about 4 cm. from the portal. The small intestine thereupon became somewhat cyanotic, the veins engorged. No further change being noticed after ten minutes' observation, the abdomen was closed. Return of consciousness after operation very slow, with shallow and rapid respiration and slow pulse. Complete recovery in two hours. For three days after operation, however, the posterior extremities were stiff and spastic and the animal walked with a typical "steppage" gait. The reflexes here slightly exaggerated. These manifestations disappeared on the fourth day. The second day after operation faces blood-stained. Some loss in weight, entirely regained subsequently.

October 7, ether narcosis. Curved incision for exposure of portal vein as described in Exp. 3. Splemic vein (vena gastrosplenicis) exposed near entrance into the portal and there ligated. Spleen at once became cyanotic and enlarged. A ligature (silk) was placed about the portal vein above the gastrosplenic as a guide for the subsequent operation. Suture of abdominal wall in layers. The dog recovered promptly from narcosis. Except for suppurative of the abdominal wall at the point of exit of the silk ligature about the portal vein and a moderate loss in weight (down to 8330 gm.) convalescence normal.

October 11, incision just median to previous one. Slight localized peritonitis found about portal vein, with small quantity of turbid fluid but no pus. Ligature about portal freed from adherent omentum and tied. Abdominal incision closed about a superficial drain. Prompt recovery from anesthetic. Dog active, took nourishment well, seemed quite normal until the third day after operation, then became apathetic, took little food and began to

<sup>1</sup> Kusnetzow, *Russk. Vrach.*, 1900 Nos. 32 and 33 (abstracted by Gickel in *Zentralbl. f. Chir.*, 1901, No. 4).

<sup>2</sup> Ito and Omi, *Deutsche Ztschr. f. Chir.*, 1901-2, No. 62.

<sup>3</sup> Solowieff, *Virchows Archiv*, 1875, 150.

<sup>4</sup> Ito and Omi, loc. cit.

lose weight. Evidently a low grade of peritonitis. Animal sacrificed the sixth day after operation.

*Post-mortem:* Pus in abdominal wall. Abscesses in omentum. Portal vein completely occluded 2 cm above the entrance of the gastrosplenic vein. Localized peritonitis about the vein. The branches of the portal found ligated as described in experiment. Spleen somewhat enlarged and firm. Intestinal wall somewhat engorged, shows remains of several old submucous hemorrhages. A collateral circulation had evidently already begun to develop. *The gastrophatic omentum (ordinarily very thin and bloodless) is thickened and vascular, numerous fine vessels coursing in it from the region of the stomach to that of the attachment to the liver.* Several anastomotic arches between branches of the portal vein and the inferior vena cava. The liver itself quite normal.

Without entering at this point into the details of the development of a collateral circulation (such as that described in the previous experiment), it is evident that the results of portal vein ligation hinge largely upon such development. It was therefore natural that the attempt should have been made to experimentally establish collaterals by means of omentopexy and then to ligate the portal vein at a subsequent operation. In fact, occasional successes by this procedure have been reported (Tilman,<sup>1</sup> Bozzi,<sup>2</sup> Kusnetzow<sup>3</sup>). In the preantiseptic era both Oré and Bernard found that extensive peritoneal adhesions (the result of infection at the time of operation) carried the collateral circulation and that the portal vein could, as a result, be successfully occluded. The establishment of collateral circulation by such methods is not susceptible of practical application to the human being. I therefore determined to attempt complete ligation of the portal vein by several operations directed at the vein itself, to ascertain if dogs would live under such circumstances, and if a definite type of collateral circulation would regularly develop.

The plan was to moderately narrow the lumen of the portal vein at the first operation, at the second operation, several days later, to place a ligature that would further encroach upon the lumen, finally, to completely ligate the vein, at either the third or the fourth operation, depending upon the behavior of the intestine when the vein was provisionally

clamped off.<sup>4</sup> This general plan was successfully carried out in several instances. A single example will suffice for the description of the details.

*Experiment 10.* Tan-colored dog, female, weight 8310 gm. Ether narcosis with preliminary morphin in all the operations.

September 26, 1912, usual curved incision for exposure of portal vein. By dividing the layer of peritoneum in front of it, the portal vein was isolated almost its full extent above the gastrosplenic entrance. Was then surrounded by a silk ligature passed through one cut edge of peritoneum in order to fix it. The ligature gently drawn upon until the lumen of the vein remained one half the original size. Ends of ligature left fairly long for future guide. No evidence of disturbed intestinal circulation. Peritoneum carefully sutured, according to a method described by Neuhoff and Wiener<sup>5</sup> to avoid omental adhesions. Animal recovered promptly from operation, quite normal next day. Appetite good. Slight loss in weight.

September 30, incision to right of previous one. Abdominal wall more vascular than before. Omentum not adherent. Ligature around portal vein found to have (about) half occluded it. The ends of the ligature caught in a forceps and twisted until the vein was about three fourths occluded. No phenomena observed in the intestines. The ligature, therefore, permanently fixed in its twisted position by a second ligature tied around it and stitched to the adjoining peritoneum. Careful layer suture of abdominal wall. After operation, slight abdominal distention but no appreciable change in pulse or respiration. Rather slow recovery.

October 1, slight spasticity and "steppage" gait of hind legs. Retention of urine over night. Takes little nourishment.

October 2, general condition better. Manifestations in posterior extremities gone except for somewhat increased reflexes. Stool normal. Weight, 7850 gms.

October 4, condition practically normal. Slight suppuration in the wound.

October 6, vertical incision median to original one. Ligature about portal vein found with some difficulty. Vein temporarily clamped to see if phenomena in intestines occurred. No change in ten minutes. Portal vein accordingly completely ligated near its entrance into liver. Layer suture of abdominal wall. Prompt recovery from anaesthesia.

October 7, dog in normal condition.

<sup>4</sup>For this purpose a *serris-fine* was employed. In an earlier part of this paper the extensive engorgement of the portal district and the cyanosis and distention of the intestines were described as the result of complete ligation of the portal vein. This observation was employed as a guide to determine if sufficient collateral circulation had developed to permit safe ligation of the vein. In one experiment, for example the vein had been half ligated four days before, and now complete clamping of the vein resulted in pronounced distention of the bowel in a very few minutes. The clamp was removed, the lumen of the vein was further compromised by a ligature, and the vein was not completely ligated until a subsequent sitting.

<sup>5</sup>Neuhoff and Wiener. Surg. Gynec. & Obst., April, 1910.

<sup>1</sup>Tilman, Deutsche med. Wchnschr., 1899, No. 18.

<sup>2</sup>Quoted by Schiassi in the Semaine med., Par., 1909, No. 29.

Loc. cit.

October 15, after moderate loss in weight (down to 7100 gms.), return to practically normal. General condition excellent.

November 1, nothing abnormal noted to date. Animal sacrificed.

*Post mortem:* Congested tongue of omentum adherent to anterior abdominal wall. A few vascular adhesions between coils of intestines. Inconspicuous anastomoses between hepatic and diaphragmatic vessels and the gastric and œsophageal veins. Anastomoses between some branches of the portal system and branches of the vena cava. A branch of the vena cava accompanies the hepatic artery into the liver (this vein is larger than normal). No dilatation of the hæmorrhoidal or periumbilical veins.

The gastrohepatic omentum, normally thin and transparent, is strikingly vascular. Numerous vessels ascend in it from the region of the stomach, duodenum, and pancreas and enter the liver over the collapsed branches of the portal vein. Some of these vessels, however, do not enter the hilus of the liver but pass directly into it at various points.

The portal vein is completely obliterated by the ligature 2 cm. below its upper end, the ligature is deeply embedded in the wall of the vessel. The liver perhaps slightly firmer than usual. Otherwise normal in size, shape, and color. Spleen firm and somewhat enlarged. Gastro-intestinal tract entirely negative. No engorgement of the vessels of the portal district. Remaining viscera negative. Spinal cord negative.

There was not sufficient time for microscopical examinations to be made in Prof. Pick's laboratory and they were done by Dr. L. Moschowitz of New York at Prof. Pick's request. I am indebted to Dr. Moschowitz for the following report:

"Examination of the sections of the liver does not reveal anything particularly abnormal. The only change is a slight dilatation of the capillaries. The cells stain well and the capsules of Glisson show nothing. Perhaps there is also dilatation of the portal vein branches in the Glisson capsules but the increase in size can only be considered as very moderate. The section from the gastrohepatic omentum shows numerous veins of good size. The veins are normal in appearance. The branches of the hepatic artery seen in the sections do not show the slightest endarteritis." (See illustration.)

It has therefore been established that complete occlusion of the main trunk of the portal vein is experimentally feasible provided such occlusion be gradually induced during a period of several days. An efficient collateral circulation develops, chiefly in the gastrohepatic omentum.<sup>1</sup>

<sup>1</sup> The experimental work reported is incomplete in several respects. Thus, the longest period in which the vein can be closed off has not been determined, nor whether the animal lives indefinitely after the operation. The collateral circulation may possibly be of a different type after prolonged periods and changes in the liver, particularly may then

What analogy exists between the experimental and the clinical findings? Since 1837, when Gintrac<sup>2</sup> collected six cases of occlusion of the portal vein in the human being, a considerable number of such instances have been reported. Some of the patients have lived many years with complete stenosis of the portal vein. The resultant anastomotic circulation was considered analogous with that developing in cirrhosis of the liver (enlargement of the œsophageal, rectal, paraumbilical veins, etc., so generally known through the writings of Frerichs<sup>3</sup> and others). Recently, however, Charpy<sup>4</sup> discovered an additional series of vessels in the lesser omentum that play an important part in the anastomotic circulation. Pick,<sup>5</sup> in 1909, was the first to clearly indicate the significance of these veins in the lesser omentum. He reported a case in which the portal vein had been occluded for many years (by a cavernoma of the vessel wall) and demonstrated that the portal blood was carried to the liver chiefly by these veins in the gastrohepatic omentum. Furthermore, Pick pointed out that, in hepatic cirrhosis, a useful anastomotic circulation is one carrying the blood away from the liver ("hepatofugal"), in obliteration of the portal vein, on the other hand, a useful circulation would be a "hepatopetal" one.<sup>6</sup> The latter, via the gastrohepatic veins, is clearly demonstrated in his case. Pick added that the hepatopetal collateral circulation may develop in adhesions between the liver (and gall-bladder) and the remaining abdominal viscera (stomach, intestine, omentum, etc.), as in a case of portal vein occlusion reported by UMBER.<sup>7</sup>

The experimental observations that I have recorded thus correspond with the clinical findings. They also demonstrate two important points that have not as yet been established clinically—(1) that the collateral

he found. A clamp devised to slowly occlude the vein would greatly improve the experimental technique. Haisted a clamp as made for me in Berlin did not prove satisfactory. Metabolic studies upon animals after portal ligation would surely prove of interest.

<sup>2</sup> Schmelz Jahrb. xclii.

<sup>3</sup> Anatomisch Atlas zur Klin. der Leberkrankh., Braunschweig, 1865.

<sup>4</sup> Traité d'Anat. humaine de Poirer. Angéologie 1898, u.

<sup>5</sup> Virchow's Archiv, cxvii.

<sup>6</sup> These terms originated by Pick are useful (though hybrid) ones and will be employed in this paper.

<sup>7</sup> Mitt. d. Grenz. d. Med. u. Chir., 1901, vii.

circulation develops with great rapidity; (2) that the collateral circulation in the gastro-hepatic omentum is the one that regularly develops.

The demonstration of a collateral *hepatopetal* circulation is of considerable significance in connection with the surgery of the human portal vein, for ligation of the vein becomes conceivable when there is evidence that blood from the portal territory enters the liver after the portal vein is ligated—in other words, that the functions of the liver may continue in an approximately normal manner.

What are the clinical observations of the effect of complete portal stenosis upon the liver? In all the cases that have been reported (not including, of course, those of portal thrombosis associated with hepatic cirrhosis) the liver has been found of normal size and gross appearance and of practically normal microscopical structure.<sup>1</sup> Furthermore, some of the patients have lived as long as thirty years after the occlusion has been established, with but transient if any symptoms pointing to inadequacy of the collateral circulation.<sup>2</sup> Although my experimental observations were not of sufficiently long duration to be of definite value in this connection, it may be tentatively stated that they correspond with the clinical ones. Very soon after the portal vein is completely ligated the animal is in good physical condition, presents no abnormal manifestations, takes nourishment in the usual manner, and remains of normal weight. Upon post-mortem examination, the liver is found to be of macro- and microscopically normal structure.

I wish to add some remarks upon the significance of these experimental and clinical observations for the treatment of suppurative pylephlebitis. The description of the symptomatology of the affection is not within the scope of this paper; however, it may be stated that pylephlebitis oftentimes presents a clinical picture that permits the diagnosis to be made with reasonable certainty. The affection, complicating appendicitis especially, is not a

rare one and almost invariably ends fatally. Indeed, it is difficult to conceive of any other termination for the vast majority of the cases. Nevertheless, no methods have been employed in an attempt to check its progress. Any procedure, no matter how radical, that offers a possibility of cure of so fatal a condition should be advocated. I therefore wish to suggest ligation of the portal vein for the treatment of suppurative pylephlebitis. The argument, already indicated in several places, continues as follows: Although some cases of suppurative pylephlebitis end fatally with great rapidity, some live weeks and even months. Especially in the latter, post-mortem examination demonstrates that the portal vein is often more or less occluded by suppurating thrombi, periphlebitic inflammation, etc. Collateral paths for blood from the portal district must have been established in these instances. Therefore ligation of the portal vein may only complete the development of a collateral circulation begun or already far advanced. The seriousness of suppurative pylephlebitis depends not so much upon the suppuration in the vein itself as upon the involvement of the liver. The liver may be the seat of multiple abscesses, even in an early stage of pylephlebitis; even in such instances, however, ligation of the portal vein will cut off the source of the hepatic infection and the liver may take care of those foci that have already developed in it. That patients suffering from multiple abscesses of the liver may recover has been amply demonstrated. Therefore clinical evidence pointing to invasion of the liver is not, in itself, a contraindication to the procedure suggested.

The details of the operation can be developed by experience alone. Should the vein be ligated in several sittings (as in the experiment) or should this be accomplished by a clamp that gradually occludes the vein (such as that devised by Halsted)? Or finally, should the vein be completely ligated at one sitting? It is possible that only cases of pylephlebitis that have existed for some time will prove to be operable, cases in which the vein is more or less occluded and the collateral circulation has had an opportunity to de-

<sup>1</sup> Park (loc. cit., p. 523) reviews the trivial microscopical changes that have been found in the liver in some instances of portal vein occlusion.

<sup>2</sup> There is no evidence that the liver has not functionated normally in these cases. Recently developed tests were not employed in any of them; it is possible that some disturbance of hepatic function could have been determined by such tests.

velop Under such circumstances, at any rate, immediate ligation would seem the operation of choice. If thrombosis has not extended above the splenic vein, the portal should of course be ligated below that vessel. If the portal involvement has extended above the splenic vein, the latter should also be ligated, beyond thrombosis that may have extended into it, if possible. The question of procedure in involvement of the portal vein above the highest surgically accessible level must remain an open one. Ligation through the thrombotic area should be considered because the source of infection of the liver will thereby be greatly diminished in area, and the bacteria will not be swept into the liver by any blood current still present in the portal vein. The problem of dealing with the pus in the vein has not been considered. It may prove feasible to drain the vein, as suggested by Gerster,<sup>1</sup> provided the blood stream in it is completely or almost completely sidetracked. The possibility of excision of the thrombosed portal vein is one for the future to determine. Whatever the operation of occlusion practiced upon the portal vein, it should be combined with an omentopexy. This additional procedure is advocated because it may prove a valuable aid to the collateral circulation that has already developed at the time of operation or that may develop after operation. If the omentum is partly attached to the liver and partly to the abdominal wall, it should theoretically assist both the hepatofugal and the hepatopetal flow of blood.

## RÉSUMÉ

1. Experimental complete ligation of the portal vein is immediately fatal. Death results from shock.

2. Apparently normal life is compatible with complete occlusion of the portal vein, if gradually induced. This is true for the human being and the experiment. In the latter, gradual obliteration of the lumen can be successfully induced in a very brief period.

3. The liver remains practically normal with complete occlusion of the portal vein existing for a short time (experimentally), and for very prolonged periods (clinically). The reason for this lies chiefly in the development of a hepatopetal collateral circulation. The latter is demonstrable clinically and experimentally. In the experiment the hepatopetal circulation appears to develop regularly in the gastrohepatic omentum.

4. An active treatment of suppurative pylephlebitis is suggested on the basis of the above summarized results. Ligation of the portal vein, with the modifications embodied in the paper, is the treatment that is advocated. The operation is worthy of trial in an attempt to improve the results of an affection so regularly fatal.

It is a pleasant duty to conclude by an expression of my thanks to Prof. Pick for his kindness in supervising the work and for his courtesy in placing all the laboratory facilities at my disposal.

## CONCERNING SACRAL ANÆSTHESIA

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THE idea of making use of the extradural space as the place of application for different active agents originated with the Frenchman Cathelin. He pointed out that it is possible to inject watery solutions into the extradural space by puncture of the lower end of the sacral canal, the hiatus canalis sacralis. By injection of cocaine solu-

tion he thus brought about, on dogs, an analgesia which was sufficient for surgical purposes. He cautiously made use of this method on humans for the amelioration and cure of certain nervous bladder troubles. This method was then further developed by Stöckel, who was the first to introduce it in Germany and to make use of it in obstetrics, and who tried to bring about painless de-

<sup>1</sup> Gerster, Tr. Am. Surg. Assn., Phila. 1903

livery by sidetracking the sacral plexus by means of novocain and eucain solutions. Stöckel's method was, however, later given up by him, since the anæsthesia was only effective for a certain time in which the labor could not be brought to an end. The interest in sacral or extradural anæsthesia was revived by researches of Lâwen and Gros. They proved, experimentally and clinically, that the anæsthetizing strength of a sodium bicarbonate solution is greater than that of the hitherto used sodium chloride solution. Lâwen in particular brought forward several more modifications in the technique of puncture and injection, and reported favorable results which he had been able to accomplish with these modifications of the sacral anæsthesia in operations below the symphysis.

The Freiburg Frauenklinik then continued the experiments started by Lâwen, at first with his technique, then went on with its own technique to experiment in obstetrics and gynecology. In obstetrics, sacral anæsthesia as modified by Lâwen was used for the introduction of the scopolamin-morphin Dammerschlaf<sup>1</sup> (Gauss), in order to bring about freedom from pain during the entire labor. In gynecology, sacral anæsthesia was used at first in performing "low" operations, that is operations the nerves of which were fed from the lower part of the plexus lumbalis; later the Freiburg clinic proceeded to expand the indications for sacral anæsthesia to all abdominal operations by using the so-called "high extradural anæsthesia."

I report herewith the technique of low or high extradural anæsthesia used by us in the Freiburg Frauenklinik, the experience we have had with it, the advantages or drawbacks of the method, and finally the indications which the Freiburg clinic uses in the employment of sacral anæsthesia.

#### I. TECHNIQUE

The principal new points in the Freiburg technique are

1. The combination of sacral anæsthesia with a deep veronal scopolamin-morphium Dammerschlaf
2. The alteration of position during and after the injection
3. The increase of the novocain dose.

<sup>1</sup> "Twilight sleep"

*Preliminary narcosis.* We require, as well for low as for high extradural anæsthesia, the production of a deep Dammerschlaf, in order to mitigate the pains attendant on the sacral puncture and sacral injection and to wipe them from the memory. Also to take from the patient the unpleasant impressions of the puncture, and especially the position. Furthermore, we have been able to prove as a matter of experience that the depth of the anæsthesia, especially the relaxation, is dependent on the quality of the preliminary scopolamin-morphium Dammerschlaf. All patients receive 1 gm. of veronal on the evening before and  $\frac{1}{2}$  gm. of veronal on the day of operation. A reduction of the dose in that  $\frac{1}{2}$  gm. of veronal is given on the evening before, is carried out with all patients who are markedly cachectic, as, for instance, on very debilitated carcinoma patients. With all other patients we have kept to this dosage and have seen no untoward results. On the day of the operation itself the patients receive scopolamin morphium, scopolamin pantopon or of late scopolamin narcophin, with which we have obtained the best results. This last combination I would like particularly to recommend because a moderately good analgesic action of the Dammerschlaf is obtained; and in addition the Dammerschlaf lasts longer than with the use of scopolamin morphium or scopolamin pantopon, a condition which is found very desirable when some unforeseen postponement of the beginning of the operation is made necessary. The dosage is as follows. We give three hours before the beginning of the operation 0.0003 scopolamin and 0.01 morphium. Then,  $\frac{1}{4}$  hours before the beginning of the operation, that is  $\frac{1}{4}$  hour after the first injection, we give the same dose, again — that is 0.0003 scopolamin and 0.01 morphium.

Narcophin is a preparation put on the market by a German firm. Should morphium be given instead of narcophin the dosage is the same, except that 0.01 morphium takes the place of 0.03 narcophin. It is then better, however, to give the injection somewhat later, according to our experience — the first injection  $1\frac{1}{2}$  hours, the second  $\frac{1}{4}$  hour, before the beginning of the operation. The same holds good in the use of pantopon, which is given in a dose of 0.02 gm. This is to be considered as normal dosage. It is reduced by us to a half under the following conditions: in old patients and in patients who have a body weight much under 105 pounds. We have not set a definite limit for the age, because senile changes make their appearance in some early, in others late. In general women of the working class beyond fifty years of age, and those of better classes beyond sixty, are to be considered old. It is well to control the condition of the Dammerschlaf about one half to three quarters of an hour before the intended operation, that is, one speaks to the patient lying in the preparation room, or tests the analgesia by lightly pinching the skin. If the patient is still quite wakeful, we conclude that she re-

acts little to alkaloids and we give her one half of the normal dose already described, i. e., morphium 0.005, scopolamin 0.0005.

It must be here noted that the object of the scopolamin morphium Dammerschlaf is not the induction of absolute anaesthesia, i. e. complete narcosis, but a condition of amnesia. It is almost the rule that patients in Dammerschlaf, for example, give indications of more or less severe pain at the time of the sacral puncture. They are not conscious of the pain, however, and forget it. If one asks a patient who was injected during the scopolamin-morphium Dammerschlaf and who gave lively demonstrations of pain, on the day after the operation, or even on the evening of the operation, if she remembers having felt pain or if she remembers anything of the puncture, etc., one almost always gets a negative answer. This amnesia is a specific action of scopolamin.

*Technique of the sacral puncture* We carry out the sacral puncture

- 1 With the patient lying horizontally on her side
- 2 In the knee-elbow position, with the patient horizontal or with elevated pelvis.

Puncture in the side position has the advantage that the position is easily obtained, the drawback that the puncture itself is more difficult. Puncture in the knee elbow position has just the opposite advantage and disadvantage. The hiatus canalis sacralis, the lower opening of the sacral canal, is chosen as the point of entrance. This is to be recognized through the skin by the two cornua sacralia. To orient oneself, one palpates the processus spinosi of the sacrum down to its lowest part, then feels that the processus spinosi seems to divide in a fork-like manner, and thus comes upon a triangular space which is bounded on the sides by the two cornua sacralia and gives the elastic resistance of a deep-lying membrane. The hiatus is easily found when puncturing in the knee-elbow position, as it lies in the continuation of the anal groove. When the patient is in the side position it is somewhat above the anal groove, as in the side position the weight of the gluteal muscles causes the skin to be drawn over it. The hiatus is best found by injecting one finger breadth away from and above the anal groove. The entrance is best obtained at an angle of about  $45^{\circ}$  from the body surface.

*Instrumentarium of the sacral anaesthesia* 1. Puncture needle. We make use exclusively of a needle the chief feature of which is that it consists of a hollow tube in which is a sharpened mandrin, which can be immediately withdrawn. We puncture with the mandrin pushed forward until we have entered the canal, then immediately withdraw the sharp point and introduce the empty tube, which is made of platinum or silver, further into the canal. Injuries to the veins of the extradural space are thereby avoided which otherwise may easily occur with the use of stiff, sharp instruments.

2. The tilting chair for the production of the

knee-elbow position. We make use of a specially constructed chair in which the patient can be comfortably seated. She is there swung so that she is brought into knee-elbow position with a more or less elevated pelvis. This rather expensive apparatus can, however, be improvised if one fixes on the operating table supports for the shoulders and pelvis. One can then bind the patient to the supports with towels, and thus easily bring her into knee-elbow position and produce the necessary amount of elevation of the pelvis by means of the operating table.

3. Syringe. We always use a 20 cc. record glass syringe.

*Trial injection* Whether or not the needle lies correctly in the sacral canal, one can discover on injecting by the degree of resistance. If the needle lies correctly the fluid is injected almost without resistance. If the resistance is greater, or if on injection a subcutaneous swelling appears, then the needle has not entered the sacral canal, but is in the periosteum or subcutaneous tissue. Hence a trial injection is to be made before each sacral canal injection, in order to be certain that the canal has been entered. Novocain solutions should not be used for this trial injection, one does best to inject 5 to 10 cc. of an indifferent solution, such as sodium bicarbonate or salt solution. Should it be found after an injection of large quantities (10-15 cc.) that the needle does not lie correctly, the patient has at any rate absorbed no active drug.

*Testing for injuries of the veins and lumbar cavity.* Even with the use of the above described puncture needle, with withdrawal of the mandrin, injuries of the veins of the extradural space can of course occur. These injuries are dangerous, because the sacral injection of novocain can then turn into an intravenous injection. One tests for injuries of the veins by lowering the pelvis after the sacral puncture. Injuries of the veins occasionally occur without an immediate gush of dark red blood. When the pelvis is sunken, however, and a vein of considerable size is injured, blood will almost always issue. If only a little blood runs out, then only a small vein is injured and the injection can be completed. If blood issues in quantities or in spurts, then one should by all means desist from the sacral injection.

By means of this lowering of the pelvis it can also be noted if the meningeal cavity has been injured. According to anatomical examinations, the distance from the hiatus sacralis to the lower end of the lumbar cavity is 6 cm. Should a variation occur, however, in spite of this, in which the lumbar cavity extends abnormally deep, then there exists without this test the possibility that the lumbar be punctured. If, with lowered pelvis, a profuse watery fluid is seen to run out, one must of course desist. We have not had, in our whole series of cases, a single puncture of the lumbar cavity.

*Mixture and preparation of the novocain solution* We still recommend for the present novocain as the

anæsthesia for sacral anæsthesia. We have used other anæsthetics on 13 of our cases, but have up to the present time found novocain to be relatively the least harmful and the most effective anæsthetic.

**Sodium bicarbonate solution.** The essential new point which Læwen brought out in his work was the introduction of the solution of sodium bicarbonate as a vehicle for novocain (see p. 489). With the exception of two cases we have made use of novocain in sodium bicarbonate solution. It was shown by the observations of Stöckel and of Læwen that results may be obtained with the simple novocain-chloride solution, but they are inconstant. For control, I likewise have given in two cases novocain in sodium chloride solution; both times the anæsthesia appeared later and was not so complete as in those cases carried out with the novocain-sodium bicarbonate solution. It must therefore be recommended that, at least in the use of novocain, this solution always be used. Læwen has given several formulæ. We use almost exclusively the following: *Natr bicarb. puriss.*, 0.25, *Natr chlorat.*, 0.5, *Aq. dist.*, 100.

**Addition of adrenalin.** It is recommended to add adrenalin to the sodium bicarbonate and novocain solution in order to bring about a contraction of the blood-vessels, which on the one side is thought to hinder a too rapid absorption of the novocain by the blood, and thus an acute intoxication, and on the other is thought to guarantee a delayed resorption, and thus a more continued action. According to our observations, however, it seems pretty certain that the addition of adrenalin brings about no such appreciable delay in resorption as one might expect. It appears as if the thin-walled veins of the extradural space do not react strongly to adrenalin. If one adds suprarenin or adrenalin immediately to the sodium bicarbonate solution, it is destroyed in a few moments if the solution is warmed to the right temperature, that is, it is converted into an inactive substance by the strong alkaline reaction of the solution, this is shown by a reddish or, later, a yellowish color. In order to avoid this oxydation of suprarenin we add  $\frac{1}{4}$  gm. natrium sulphurosum to the novocain-bicarbonate solution, for researches of Trendelenburg in Freiburg have shown that the oxydation of suprarenin is postponed for a long time by the addition of this substance. The amount of suprarenin which we add is  $\frac{1}{4}$  cc. of a 1:1000 solution.

**Preparation of the novocain solution.** According as we wish to use a 1 per cent or a  $1\frac{1}{2}$  per cent solution of novocain, we add to 100 cc. or 75 cc. of the above described sodium bicarbonate solution 1 gm. of novocain. The mixture is then boiled for a moment, whereby the sodium bicarbonate is converted into the more active sodium carbonate, and at the same time a sufficient degree of sterilization is obtained. The solution is then cooled to 38° C., and if not used at once is kept best in an incubator.

**Dosage of novocain.** By far the most difficult chapter in the subject of sacral anæsthesia is the

dosage of novocain. The Freiburg Frauenklinik has itself been able to work out a definite scheme of dosage only after a long experience, now favorable, now unfavorable. Whether or not it possesses permanent value is not to be said in advance, at any rate we have up to the present time had our best results with it. Our dosage plan is as follows:

1. Dosage in low anæsthesia. *Normal dose* 0.6 gm. In patients under 105 pounds body weight, in cachectic patients, in those who are deep in Dämmerschlaf, and in operations which probably will not last over 45 minutes, only 0.5 gm., in hemorrhoid operations, 0.4 gm.

2. Dosage in high anæsthesia is somewhat more complicated. The minimal dose is here 0.5 gm., the maximal 0.8 gm. The factors which have to be considered are: 1. Body weight, 2. cachexia; 3. icterus, 4. habituation to narcotics, 5. Dämmerschlaf, 6. nature of the operation.

As a normal dose we take 0.7 gm. We take 0.1 gm. from this dose if the patient weighs less than 105 pounds, if she is very cachectic or icteric, if she is deep in Dämmerschlaf, and in short operations such as uncomplicated appendectomies, Alexander Adams' tubal sterilization, operations for inguinal hernia, and so forth. We increase the dose of 0.7 gm. by 0.1 gm. in patients who weigh over 126 pounds, in patients who are accustomed to narcotics, with poor Dämmerschlaf, and in long operations — myomectomy, gall-bladder and kidney operations. We take 0.2 gm. from the normal dose if the woman has a body weight under 84 pounds.

All of these considerations can annul each other. For example, if a woman is in poor Dämmerschlaf, one would add 0.1 to the dose, if, however, she at the same time has a body weight under 105 pounds, 0.1 must again be subtracted, and these two points have equalized each other. In order to avoid an immoderate summation of addition or subtraction, we make it a rule not to use less than 0.5 gm. or more than 0.8 gm. This dosage is so arranged that above all things the principle of safety is preserved. In many cases we could doubtless have given more novocain and thus obtained better results as far as anæsthesia and relaxation were concerned. I should advise, however, in spite of that, to hold to the cautious dosage. Very heavy persons had best not be given sacral anæsthesia at all. One does not regret having occasionally to give in combination a little chloroform and ether. The doses which will be necessary are so small that they cannot produce any mentionable damage.

**The position during and after the injection.** For low anæsthesia we almost always use the side position. We puncture in the side position, and inject the solution slowly, taking from one to one and a half minutes. The woman lies in the side position horizontally. Immediately after the injection she is brought into position on her back, and a



slight elevation of the pelvis is used, or none at all. One can usually begin the operation on the perineum in two to three minutes. It is different where one is to produce high anaesthesia. We use here the knee-elbow position exclusively. We puncture and inject also with the pelvis elevated. The patient is brought onto the tilting chair or the prepared operating table in the knee elbow position with moderately elevated pelvis. In this position the puncture is made, likewise the injection takes place with uniformly elevated pelvis, about  $30^\circ$ , and finally the pelvis is still more elevated, to  $45^\circ$ . The patient is left in this position for about five minutes, then she is brought onto the operating table in horizontal position. High anaesthesia thereby usually sets in after five to ten minutes. The first sensations which are lost are the lower and upper skin sensibilities; the last anaesthesia to be obtained is in the peritoneum. Anaesthesia vanishes in the reverse order — first in the peritoneum, and last in the skin.

*Duration of the anaesthesia* As an average, the low anaesthesia lasts  $\frac{3}{4}$  to 1 hour, or 1 to  $1\frac{1}{4}$  hours. High anaesthesia averages  $\frac{3}{4}$  hour, in rare cases only  $\frac{1}{2}$  hour, occasionally, however, an hour or more. It appears as if a certain prolongation of the anaesthetic action is brought about by the addition of suprarenin.

*Results* We have carried out in all 135 low anaesthesias, 21 with novocain substitution products, which cannot be further discussed here, and 114 with novocain. In giving the results I shall follow the scheme that I have used in my former publications.

1. Good low anaesthesia of the organs lying below the symphysis, to which during the operation no inhalation anaesthesia had to be added, 62, or 54.4 per cent.

2. Good low anaesthesia to which on account of the duration of the operation inhalation anaesthesia had to be added, 24, or 21 per cent.

3. One-sided or incomplete anaesthesia which made necessary the addition of inhalation anaesthesia from the first, or soon after the beginning of the operation, 15, or 13.2 per cent.

4. Failures, 13, or 11.4 per cent.

High anaesthesia we carried out in 434 cases; of these 92 were with novocain substitutes and 342 with novocain. Of these:

1. Peritoneal anaesthesia with relaxation, 150, or 46.5 per cent.

2. Peritoneal anaesthesia with relaxation, in which, on account of the duration of the operation, inhalation anaesthesia had to be added, 73, or 21.3 per cent.

3. Incomplete high anaesthesia, i.e. in which no relaxation, but only peritoneal or skin anaesthesia, or only low anaesthesia occurred, 91, or 25.6 per cent.

4. Failures, 19, or 5.6 per cent.

It is to be noted that the amount of chloroform-ether was in general small, 10 to 15 cc. of ether alone or with a few cc. of chloroform is often enough to carry out a peritoneal operation lasting 45 minutes to  $1\frac{1}{2}$  hours. All of these cases are included under headings 2 and 3. It is certain too that, even when the anaesthesia is from the beginning insufficient, the amount of chloroform-ether and the consequent harm to the patient is much less than when chloroform and ether are used entirely for anaesthesia.

*Collateral action* The principal collateral action, and that one which most often is striking, is the extreme pallor which usually comes on one quarter to one half hour after the injection. A fall of blood pressure is doubtless connected with this pallor, and both are to be regarded as novocain action. With choice of suitable doses, as shown above, there is no danger, particularly if there was no injection into the veins. The pallor lasts for about 2 to 3 hours. Occasionally patients complain of chilly sensations. In 3 to 4 hours the action is over. It is to be admitted that at first these symptoms can appear somewhat threatening. On account of the fall in blood pressure which accompanies it, one of course should make it a rule not to use sacral anaesthesia on patients who have severely damaged hearts or vascular systems.

*After effects.* The most pleasant thing about sacral anaesthesia is the insignificance of the after effects. Post-operative vomiting practically never occurs, an advantage which cannot be praised too highly in operations on

the stomach and intestines. Headaches, too, which follow lumbar anæsthesia so often and so persistently, do not occur after sacral anæsthesia. Those cases where we observed headache had other definite causes. It is also a priori to be expected, for the puncture of the meninges, which causes the headaches, does not occur in the sacral anæsthesia. In our first trials there were, in all three times, after effects which at first seemed very unpleasant. They were cases of neuritis in the region of the nerves of the leg. Once a solution was accidentally injected too warm; in both the other cases the old technique, jerky injection of the solution, was used, whereby mechanical injury of the nerves is possible. Since we excluded these sources of error we have never had to complain of such occurrences.

#### RÉSUMÉ

Sacral anæsthesia is an anæsthesia de luxe. Its execution demands a number of trained assistants, and the technique is not simple and demands long practice. The technique has not yet been worked out to the finest points. Much is to be expected from substituting for novocain a preparation which is as efficacious but less toxic.

The main *advantages* of the method are the lack of vomiting before and during the operation, the lack of headaches in the convalescence, and, in the successful cases, the beauti-

ful anæsthesia and relaxation which alone make possible a technically perfect operation.

The *drawbacks*, outside of the already mentioned difficulty of the technique and dosage, are the fall in blood pressure and the limited duration of the anæsthesia.

On the one side sacral anæsthesia competes with inhalation anæsthesia, particularly in its extended forms, as a mixed anæsthesia; on the other side, with lumbar anæsthesia. It surpasses inhalation anæsthesia in the better relaxation which it assures and in the inconsequence of the after effects; it is surpassed by lumbar anæsthesia in the fall of blood pressure and the difficulty in technique encountered in its use. It surpasses the latter, however, in one important point, and that is the absolute absence of headache. On the ground of these comparisons, the Freiburg Frauenklinik has made for itself the following indications:

For small, short operations which require only slight abdominal relaxation, e. g. uncomplicated appendectomies, we use the inhalation anæsthesia with chloroform-ether or laughing gas.

For larger operations on women whose heart and vascular system is not intact, or on very fat women with a thick fat layer over the hiatus canalis sacralis, we use lumbar anæsthesia.

For all other cases, sacral anæsthesia.

## OSTEOPLASTY

By JOHN B. MURPHY, A. M., M. D., LL. D., CHICAGO

**I**N a series of articles on the surgery of the bones, joints and tendons, published recently in the *Journal of the American Medical Association*, I considered this subject in many of its phases, although lack of space made it impossible to more than touch on the details of this work.

While plastic operations on the bones have been performed for a considerable number of years by many men, the subject is still in its infancy, because we have not until now arrived at the stage where we can make positive

statements on practically all the emergencies which may arise in the course of this work. We have, however, formulated definite, clear-cut principles which control the essential features of all this class of surgery. It is no longer in the experimental stage but is an established fact. Experimental study by many European and American surgeons has done much to develop this phase of surgery, and we are now in a fair way to reach finality.

I will not weary you with a recital of all the experimental work done by my associates and

me, and anything I may say to you will be based entirely on that work and on the very extensive clinical observations which I have had the opportunity of making since 1903, when I first became actively interested in the subject, and earlier desultory work. Since that time, particularly during the last four or five years, I have devoted a great deal of time, thought and study to osteoplasty and arthroplasty. My results have been such that I have been able to draw some definite conclusions, although each day some new problem presents itself which must be solved.

Anyone who undertakes this work must have a very complete knowledge and a clear conception of the embryology and anatomy of the bones and joints, as well as of the method of regeneration, not only in bones, but also in the soft tissues. No matter how this work is done, it must be carried out along definite lines which approach the natural course of embryology and osteogenesis as closely as possible.

I believe it may be said with some positiveness that the question of what sort of material and from what source it should be taken, in osteoplastic work, has practically been solved. While implantation of foreign material or of homo material derived from a subject of the same species is useful in a measure as a mechanical support or irritant, its utility is practically confined to a few situations in the body, and even then only a few materials are advantageously at our disposal. Furthermore, it is not at all a matter of supplying a defect, but of supplying the proper means which will favor the reproduction of tissue to fill in the defect. Anyone who has done osteoplastic work knows this to be true. We cannot supply a defect in a bone, but we can resort to procedures which will make for regeneration from the bone already present or remaining so as to fill in the defect.

As a result of my work I have formulated in my own mind a series of laws which must be observed if one would meet with success in osteoplasty. To achieve the best results in the work of bone grafting and bone transplantation we must observe the following:

1. (a) Normal periosteum completely detached from bone and transplanted into a fat or muscle tissue bed in the same individual,

if he be young, may produce a permanent bone deposit, but only if osteoblasts remain attached to the lower layer of the periosteum. The periosteum of itself is not osteogenic; it is rather a limiting membrane, and therefore it is of advantage to transplant it with the bone, although it is not essential to do so. (b) Normal periosteum, transplanted into another individual or animal of the same species and under the same conditions, rarely if ever produces a permanent bone deposit. Any bone which is formed from such periosteum will sooner or later be absorbed. The osteogenetic effort of this periosteum is early exhausted. (c) Normal periosteum transplanted into another species never produces a permanent bone deposit.

2 Strips of normal periosteum raised from the bone, detached at one end but left attached to the bone at the other, if turned out into the surrounding tissues, usually have bone produced on the under surface, at the osteoperiosteal angle, but not unless there are osteoblasts attached to it. This is an etiologic factor of many of the exuberant calluses in fractures in the neighborhood of joints. The periosteum and some of the osteal cells are torn loose by the muscular contractions at the muscle attachments or elevated by the fracture, and these develop traumatic exostoses.

3 Normal periosteum transplanted into other individuals or animals of the same species and contacting at one end with exposed or freshened bone rarely ever produces permanent bone even for a small extent at its basal attachment, and never produces bone for its full length.

4 When bone with its attached periosteum is transplanted into muscle, fat or other soft tissue in the same individual and free from bony contact, it may for a very brief period of time show osteogenetic powers, but eventually the formation of new bone ceases, and all of the bone, the transplanted as well as the new bone, is absorbed, except in the cases of very young children or infants. When transplanted into another species it is always absorbed.

5 Free bone from which the periosteum has been detached, when transplanted into muscle or other soft tissues, always dies and is ultimately absorbed.

6 Bone, with or without periosteum, transplanted in the same individual and contacting with other living osteogenetic bone at one or both of its ends, always becomes united to the living fragments and acts as a scaffolding for the reproduction of new bone of exactly the same size and shape as the original bone, provided the most perfect asepsis is maintained. This new bone subsequently increases to such a size as is necessary to give the support required by nature in the extremity in which it has been placed. It acts as a *scaffold* for the production of new bone—but allows the osteoblasts which are normally found on the Haversian vessels to travel into the Haversian canals of the transplant. When one end of such a transplanted piece of bone projects into a joint and when it is surrounded by the original joint capsule, the normal conformation of the bone end in the joint is reproduced almost in its entirety, such as the head and tuberosities of the humerus (Case 1) and the upper extremity of the femur (Case 3), including the trochanters; provided the muscle stumps are fixed to the transplant, at the time of operation, in about their normal anatomic relation with sutures.

7 The transplant, no matter how small or how large it may be, is always ultimately absorbed. It is our conviction that its rôle in the reproductive process is merely that of mechanical support for the Haversian blood-vessels and the living osteogenetic cells as they advance from the living bones at both ends and pass through the Haversian canals, canaliculi and lacunæ of the transplant. New lamellæ are deposited around the new capillaries, and these lamellæ adjust themselves in the graft in such a manner that a firm bony union is formed and the continuity of the bone into or onto which the transplant has been placed is re-established, and to such a degree as to give sufficient support to the limb long before the transplant is entirely replaced by new bone or the transplanted bone is absorbed.

We have had the opportunity of observing that ultimately all of the transplant disappears. As the new lamellæ are formed by the osteoblasts, the osteoclasts eventually dispose of the transplant, and this building up and

tearing down process by the osteoblasts on one hand and the osteoclasts on the other keep pace. As rapidly as new bone is formed in and around the transplant the old bone is absorbed. This conclusion is based not only on my personal experimental work and clinical observations in particular, but on the analysis of the clinical and experimental work done by others.

The graft per se does not possess any *osteogenetic* power; it merely serves an *osteogenetic-conductive* purpose. The regenerative force is supplied by the osteogenetic cells found normally in the Haversian canals and lacunæ of living bone. However, in order that this new formation of bone may be made possible, the transplant or graft is an absolute necessity.

We have found further in our clinical observations that unless the graft is firmly contacting with living bone the osteogenetic cells will not pass over from the living bone to the transplant. We have had one case (Case 2) and only one in our entire clinical experience in which that was demonstrated. One end of the transplant only was firmly contacted with living bone, and here a firm, solid bony union took place. The other end of the transplant had partly freed itself from its contact with the living bone, so that it was loose and not firm, while there was some callus formation at this end of the transplant there was no effort at bony union.

8. We have found from our extensive study of skiagrams of cases in which bone transplantation has been done that the graft increases in size on the surfaces in the same manner as the deposits of bone lamellæ take place in the normal growth of bone; that is, by the piling up of the deposits of bone in layers beneath the newly formed periosteum. The periosteum, it will be observed, really serves as a limiting membrane rather than an osteogenetic force. Any osteogenetic force which may be possessed by the periosteum is imparted to the periosteum by such osteogenetic cells as may be attached to its under surface.

9 When bone is transplanted to supply a defect in that portion of a bone which enters into the formation of a joint, such as the upper

end of the humerus (Case 1) or the upper end of the femur (Case 3), the muscles in the vicinity of that joint should be fixed to the transplant or firmly sutured around the transplant in the same relation as exists normally, if muscular control and normal function of both the joint and the limb are expected after regeneration of the bone has taken place. The musculo-tendinous attachments of the muscles should be sutured accurately around the graft at the point of desired union.

10 A bone covered at the end by cartilage and at the sides by periosteum, such as the phalangeal bones, even when contacting with living bone dies and is entirely absorbed. The interposition of any tissue, either cartilage or periosteum, between the surfaces of living bone will effectually prevent the passage of the Haversian vessels and the osteogenetic cells from one bone into the other, and failure of union is inevitable. That is a positive law. Regeneration can take place only when living bone contacts with living bone without any interposing substance, so that the osteogenetic cells can pass from one into the other. If the periosteum of the graft or transplant is split into shreds or ribbons, regeneration may take place, because the Haversian vessels and the osteogenetic cells may find their way from the bone into the transplant through the slits in the periosteum.

While it is possible that these theories, which really represent our conclusions in this matter, may finally be found defective in some of the lesser details, I believe that, being based on actual clinical observations, they will be found to be correct. At any rate, from a practical standpoint it is now permanently and for all time settled that the reproduction of bone through the agency of bone transplantation is both practicable and feasible, and that the extent to which it can be carried is practically unlimited.

The essential feature to be borne in mind in carrying out this work is that the transplant must contact with living bone at at least one end. If the epiphysis of the long bone has been destroyed, the bone will not grow in length from the transplant at the point of epiphyseal absence unless an epiphysis is transplanted. I have not yet demonstrated,

experimentally, that a transplanted epiphyseal line will become osteogenetic, but I feel that in young individuals it should become osteogenetic and in one case the X-rays show it was osteogenetic (Figs 77-80) and that the bone grew in length from the once dead epiphyseal line.

If the entire shaft of a long bone such as the tibia, humerus, radius or ulna be absent, then the bone must contact with the neighboring bone laterally or at one end or the other of the extremity across the normal line of the joint in order to get an osteogenetic supply, as in the case of the femur or astragalus. Subsequently an arthroplasty can be done to give the patient a movable joint.

The indications for bone transplantation which we have laid down as a guide in our work are

1 To correct deformities resulting from defective development, such as aplasia of the bones of the extremities, of the nasal bones, and of the mandible

2 To effect union in ununited fractures, no matter how remote the occurrence of the fracture, no matter whether of congenital or purely traumatic origin

3 To replace bone which has been destroyed by an infection, such as osteomyelitis, tuberculosis, etc.

4 To restore or supplant such parts of bones as may have been dislodged or destroyed by fracture, as in the case of a fracture through the head of the anatomic neck of the humerus or femur, etc.

5 To replace bone which has been removed because of its having been the seat of a non-malignant neoplasm, such as a cyst, a myeloma, or osteitis fibrosa cystica, etc.

6 To replace bone which was removed because of having been the seat of an encapsulated malignant disease, such as a chondrosarcoma or fibrosarcoma

In all cases in which we have been called on to resort to the transplantation of bone we have come to feel that the best results are obtained when the graft or transplant is taken from the crest of the tibia of the same patient. The tibial crest furnishes a splendid supply of bone suitable for transplantation; it is easily accessible and transplants of any length may

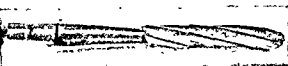


Fig. 1. The author's medulla reamer. This instrument is made in several sizes. It is used to ream out the medullary canal to receive the transplant.

be removed from it, and the defect is rapidly filled in by the osteogenetic cells of the remaining portion of the tibia. It does not weaken the strength or the weight-bearing power of the tibia, the patient is not incapacitated by the removal of such a graft, and other grafts may be taken from the same tibia at a later period when the defect has been filled in by new bone, if such a procedure is indicated. We have had to resort to it in one case (Case 4), that of a 5-year-old boy, in whom we were obliged to do a second transplantation. We found on cutting down on the tibial crest from which the first transplant had been removed, about six or seven months previously, that new bone had been formed in sufficient quantity to fill in the defect.

The transplant should be of sufficient size to give firm mechanical support. It must not only be long enough to span the gap left between the fragments of bone, but allowance must be made for the fixation of the transplant by inserting it for a distance of an inch or an inch and a half into one or both medullary canals of the remaining fragments, or when the transplant is made to serve as a bone splint, when it is not possible to insert it into the medullary canal, allowance must be made for fixing the transplant firmly to the sides of the fragments (Case 5), in other words, making a lateral approximation of the transplant to the fragments. It is then held securely in position by means of phosphor-bronze wire or chromicized catgut.

Usually the transplant is of the size of the adult index or middle finger. The sides may be unequal, so that the transplant which we have been in the habit of using measures about  $\frac{3}{8}$  by  $\frac{1}{2}$  by  $\frac{3}{8}$  inches, and of such length as is necessary, even to the full length of the tibia from the tubercle to the malleolus (Case 17). It must be sufficiently firm to be resistant to the forces exerted on it by the

contraction of the muscles. It may or may not be covered by periosteum, because as stated previously it may be advantageous to retain the periosteum, but it is not essential.

The defect that is left in the tibia fills in so rapidly that in from four to six weeks the site can scarcely be detected. After having determined on the length of the transplant by means of calipers, corresponding marks are made on the crest of the tibia as guides in the removal of the transplant. The transverse division of the bone, above and below, is made with a small saw, preferably a Hey's saw,



Fig. 2



Fig. 3.

Figs. 2 and 3. Side and top view of the author's retractor guide. The points upon the ends of the guide are inserted into drill holes in the bone so as to steady the instrument. The chisel is guided by the upper surface of the instrument. It also retracts the soft tissue from the field of operation.

before the fragment of bone is chiseled away from the tibia, because otherwise it is liable to split. The ordinary Buck chisel or cabinet-maker's chisel is used to free the transplant or it may be freed with a Zapffe saw attached to an electric or hand drill, which we are now using mostly in our work. The chisel is guided by a special retractor-guide (Figs. 2 and 3) which I devised, and which is one of the few special instruments used by me in this work. The chiseling must be done very carefully in order to preserve the integrity of the transplant. The medullary canal of the tibia may and usually is entered. The transplant is lifted up very carefully with two pairs of sequestrum forceps so as to prevent its slipping, and at no time is it allowed to come in contact with any other material or with any instrument or even a sponge that has touched anything else.

It is absolutely essential to success in this work to maintain the strictest asepsis. If this work is done in an aseptic field and in an aseptic manner, and if primary union of the soft parts is secured, the result is uniformly good. In 100 per cent of our cases up to date, asepsis has been attained.

Indications for bone transplantation are as follows.

1. Congenital or acquired defects of the nasal bones can be remedied by transplanting a periosteal covered fragment of the patient's ulna, tibia or fibula of such shape and size as is required to remedy the defect. The periosteal covering should be directed outward, and the free medullary margin of the bone inward.

The transplant must have a bony contact with the frontal bone itself, with a surface that is freed of periosteum, or with the nasal process of the frontal bone, or with the periosteum-free surface of the nasal bones. It must be fixed in this position.

The incision in these cases should be made on the side of the nose, and the flap elevated so that the graft will be completely covered with skin, and there will be no tendency to separation of the edges or exposure of the graft to air after its implantation. If possible, it is best to make a small incision near the tip of the nose, and then elevate the periosteum and make a subcutaneous pocket extending

from tip upward onto the frontal bone. Into this pocket the transplant can be placed safely and securely and the opening then closed accurately. Phosphor-bronze wire or chromicized catgut may be used to secure the fragment. A long fragment of bone should always be prepared, and when it is inserted it can be cut to the desired size and fitted into its bed.

If the nasal or frontal sinuses are open, the operation should be abandoned for the time being, because if air comes in contact with the graft, the latter will become infected and necrotize, and it must subsequently be removed.

In 1899, I grafted the second phalanx from a case of hyperdactyl into the nose. All the periosteum and both of the cartilaginous ends were retained. It healed in beautifully and for some months it seemed to be a perfect result. *Within fourteen months the entire transplant had disappeared.* The reason for this occurrence was that the graft was entirely covered with periosteum and cartilage, so that Haversian vessel invasion from the nasal or frontal bones was not possible.

In 1901 I grafted the hypotenar eminence of the hand to the nasal bones by a two weeks' fixation of the hand to the head. I took with the graft the fifth metacarpal bone shaft, and without bony contact it continued to live, because it was a part of a continuous living tissue transplant, and fulfilled the purpose for which it was intended.

In this case the bone retained its vitality because of its being contained within the fleshy flap. It did not become a dead fragment at any time, and therefore it did not need bony contact with the nasal or frontal bones.

Defects in the chin from dislocation of the mandible may be filled in by bone transplantation (see report of Case 6).

2 The repair of ununited fractures is one of the most important and practical fields for bone transplantation. It is unnecessary to consider here the causes of non-union, except to accentuate one fact that the skiagram brings out very clearly, namely, that non-union occurs frequently when the approximation of the bone ends is quite perfect and the

fragments thoroughly immobilized, either with or without Lane plates or other external or internal supports. The skiagram shows in these cases that there is no osteogenetic effort on the part of the periosteum, medulla, or compact bone tissue to span the gap with new bone. It is also a clinical fact that freshening, irritating, rubbing, wiring, or nailing these ends does not in a considerable percentage of cases stimulate the formation of an ossific callus. These failures are so numerous, that a means more constantly and uniformly successful than these mechanical fixations, without additional hazard, must be sought.

The procedure employed in implanting the transplant into the new bed will be considered separately as we take up the various indications mentioned for transplantsations.

It requires from forty to sixty days, or even longer, for the graft to become firmly attached, and therefore an external case should firmly support the limb during this time. Although it feels firm to the palpating finger within twenty days, it must not be strained until ample time has elapsed for complete regeneration to take place. It requires from seven to ten months to have a bone fully restored to the normal size.

3 The replacement of bone for osteomyelitic defects, as necrosis, etc., presents features not previously considered. There is usually a large sequestrum and a considerable suppurating area. The sequestrum must be completely removed and the suppuration must be entirely overcome and the wound healed before transplantation can be done. If it occurs in the leg, and particularly in the leg of a growing individual, the entire shaft of the bone may be involved.

The length of the extremity can be maintained during the suppurative period by implanting the head of the fibula at the knee under the epiphysis of the tibia. When this is done, however, the upper end of the fibula, including the epiphysis, must be removed, because otherwise there would be two epiphyses, that of the tibia and that of the fibula. By removing the fibular epiphysis and transplanting the fibula under the tibial epiphysis, the normal growth in length of both bones of the leg is secured and maintained. If the shaft

of the femur or humerus is involved, extension of the leg or arm must be maintained until the sequestrum is freed and the cavity healed, otherwise contraction will occur and interfere materially with the successful outcome of the case. If the periosteum is not destroyed, and with it some small fragments of bone are retained, a foreign body, such as a tube or column of magnesium  $\frac{1}{2}$  to  $\frac{1}{2}$  inch in diameter, should be inserted into the granulating wound and contact at both ends with the remaining bone, even in the presence of infection.

It will thus prevent the shortening. This is more desirable and applicable to a necrosis of the femur and humerus than in the case of disease of the tibia or either bone of the forearm. The magnesium will be entirely surrounded by granulation tissue. If the periosteum has not been destroyed by the osteomyelitic process, an involucrum of bone will form around the magnesium and the latter will ultimately be absorbed. Carbonated water, weak alkaline, or mineral acid solutions (1 to 5 per cent) may be injected to dissolve the magnesium after it has fulfilled its purpose, if it does not disappear after a reasonable length of time has elapsed. It usually is rapidly dissolved by the wound secretions with evolution of hydrogen gas. This hydrogen gas is eventually absorbed into the tissues, but it may be removed by aspiration.

When the sequestrum is removed and the space is covered with cicatricial tissue or skin, a fragment of bone from the crest of the tibia may be transplanted into the scar tissue at the site of the former bone. It must contact above and below, or at least at one end, with osteogenetic living bone denuded of its periosteum. It is preferable to have it contact at both ends.

A small contacting area may suffice to supply the Haversian vessels with osteogenetic elements, as was beautifully illustrated in one of my cases (Case 7). Here the contacting areas above and below were not larger than the surface of an ordinary lead-pencil, and still there was supplied sufficient osteogenetic force for the full reproduction of the tibia to such an extent that it could scarcely be be-



lieved that it was a new tibia were it not for a hole that remains in the upper end and which is plainly seen in the skiagram.

The periosteum over the living ends of bone must be removed carefully and the implant must be immobilized and firmly approximated at each end with phosphor bronze wire, nails or screws or any other non absorbable material which would insure continued immobilization.

In tuberculosis of the shaft, a rare condition in this country, but a common one in Scotland, as shown by Mr Stiles, the periosteum can be preserved, and preserved aseptically, as a rule. Here the bone can be reproduced fully without the implantation of a fragment of bone from elsewhere, but it will be evolved more rapidly and the conformation of the limb more perfectly maintained if a fragment of bone fills in the gap.

If bone is not accessible then a bar plate or perforated cylinder of magnesium may be inserted to maintain the normal conformation of the extremity during the process of evolution of the involucre of bone around the foreign body. As stated before the magnesium will disappear in time by absorption.

In the removal of a tuberculous shaft in the child, the periosteum should be freed from the bone, divided crosswise and the shaft evulsed from its epiphyseal attachment. *The epiphyses must never be disturbed in children*, therefore, the bone should be fractured on the shaft side of the epiphyseal osteogenetic line. The gap then remaining should be filled with some non-elastic compact supporting material during the period of regeneration.

In all of these cases (a) it is desirable that the sequestrum be removed early and completely, (b) also that the infected shaft be removed before a mixed infection of the periosteum takes place, (c) the epiphysis must never be disturbed in the case of children; (d) the normal conformation and length of the limb must be maintained either by internal or external mechanical supports or by extension, (e) the joints above and below the infected zone must be controlled carefully so that no deformity will result during the inflammatory process of destruction or during the period of restoration and repair, as these

articular deformities are often more detrimental to the patient than the primary lesion. *Over this we have practically complete control if we take the necessary precautions early.*

4. In fractures of the neck of the humerus there frequently occurs luxation of the head out of the glenoid cavity and before union can be restored one is often required to detach the head completely and replace it in the glenoid cavity. In these cases it becomes necessary to separate it entirely from its vascular supply. It then becomes a graft, as the fragment always dies and is replaced by new bone.

In this treatment the head is removed from the sub- or periglenoid space, brought out on the table, the end of the fragment is freshened, and accurately applied over the head. It is secured in this position by one or two eight penny nails, driven through the humeral shaft into the head, by an ivory peg, or a bone peg may be taken from the tibia and used in place of the nail. I believe that the wire nails fill all of the indications and meet all of the requirements in these cases. This gives a positive contact and immobilization for transmission of the osteogenetic elements from the neck into the head.

The bone rapidly regenerates from the neck side and the newly transplanted head retains its full shape and size. (Cases 8, 9 and 10.)

The head of the femur may also be luxated or, when separated from the neck, it may become necrotic through its retention and the separation or strangulation of the ligamentum teres. In the secondary operation it should be managed as above. As in the humeral separation, the head should be retained or replaced in the acetabulum and secured there either with a bone peg or two wire nails which I prefer.

As shown in one case (Figs 77-80), full regeneration of the head takes place without ankylosis of the joint following. In this case the time that had elapsed between the date of the injury and the operation was seven weeks. The head of the bone had been necrotic for that period, still its Haversian canals acted as transmitting tubes for the osteogenetic capillaries coming from the living end of the neck of the femur. The epiphyseal cartilage or line acted as a con-

tinuous osteogenetic force, as shown by the skiagram of the case four years after operation.

This forces me to the belief that a dead aseptic head of the femur from another individual might be transplanted into the acetabulum and grow, as it has in this case. The practical clinical test and demonstration of this belief, however, is left for the future.

When the head of the femur has been destroyed by absorption, due to its separation, with a fracture of the pelvis (Fig. 49), it can be reproduced by excising four fifths of the trochanter with its cartilaginous ligamentous cover and as much of the external margin of the shaft as is necessary to fill the defect left in the neck of the bone. This trochanteric fragment can be nailed to the freshened end of the neck, with the nail-head pointing toward the articulation. If it remains aseptic, regeneration of bone will take place through and into the transplanted trochanter, and the latter will make an excellent head. This was demonstrated in the case mentioned above. This man can now place his entire weight on the new head; he can lift his leg and extend it horizontally at right angles to the body when in a sitting position, which he could not do before the operation, and he can by muscular action swing it over onto the opposite knee, which shows that he has developed a new head for his femur, because otherwise this motion would not be possible. This case also supports my belief that a new head may be transplanted from an aseptic cadaver.

The trochanter may be used in the same manner in the reproduction of a head for the humerus, in cases in which ankylosis exists, or in which the head has been destroyed by disease or injury.

The earlier these operations are performed the better the results should be, as but little shortening will have taken place before the operative procedure is instituted. This favors a speedy full restoration of motion and function. (Cases 11 and 12.)

5. The restoration of bone removed for non-malignant neoplasms, such as osteofibros cystica, hæmorrhagic cysts, myeloma, etc., has also been accomplished successfully. The bone should be removed for a sufficient extent,

with or without its periosteum, depending on one's ability to make a diagnosis from the gross appearance as to the probability of malignancy. If the periosteum can be preserved, regeneration of bone will always take place, but the conformation of the limb and the speed of reproduction and restoration of usefulness of the extremity are greatly facilitated by the implantation of a fragment of bone from the crest of the tibia. Where the periosteum is removed, it is essential that the implant contact with the living bone at least at one end, so that living osteogenetic elements can pass over into the transplant.

The best plan is to implant the fragment into the medulla and to prevent its penetration to a deeper degree than that desired by blocking it with a nail placed transversely, as has been mentioned previously. If the articular end of the bone has been removed, one end of the transplant should be inserted into the capsule and relieved from pressure by an extension until such time as a soft callus or a mass of fibrous tissue has formed about the implant to fix it. The muscles should be sutured around the implant in their normal anatomic position. In one case (Case 1)  $7\frac{1}{2}$  inches of the shaft of the humerus with the epiphyseal line and articular end were removed. At the end of five weeks, on palpation, the humerus appeared to be as large as a normal humerus, although the skiagram showed small calcareous deposits only here and there. The development of compact bone proceeded along definite lines — from extensions of the periosteum, from the medulla, through the implant, up to the capsular attachment and into the joint, as shown in the last skiagram, taken nine months and some days after the operation.

Here also can be observed the evolution of the tuberosities at the points of muscular fixation. The transplanted periosteum remained as a white line without ossification for seven months after the implantation, and it was an apparent detriment to the production of bone. It was finally involuted by bone formed from the new periosteum around the new-formed callus.

This shows how completely the humerus can be regenerated and how perfectly function

of the extremity can be restored in cases in which formerly amputations were made. This patient does not know from anything, except from her inability to elevate her arm up close to the side of her head in an extended position, that any operative procedure has been performed on her. This case shows how completely a new bone may be produced from a transplant, and how it enlarges to meet the anatomic and functional requirements.

In the myeloid tumors excision of the diseased area well above and below the neoplasm should be the practice, and a bone fragment should be inserted to fill the gap. The same line of treatment is applicable in the case of hæmatogenous cysts, as these are occasionally infected and it is not safe to resort to curettement and implantation of a fragment of bone.

In septic osteomyelitic cavities fragments of bone should not be used for filling material unless the cavity is rendered absolutely sterile, and of this one can never be certain, except as the subsequent course of the disease may indicate. The aseptic blood clot of Schede will give as good results as the implantation, if asepsis is attained. The bony canopy of the osteomyelitic abscess should be retained attached to the periosteum and soft tissues after the plan of Tillmanns and depressed into the cavity at the completion of the operation but still attached to the muscle flap.

6. For malignant disease of bone, such as *giant cell sarcoma*, *large spindle-cell sarcoma*, *encapsulated chondrosarcoma* and *circumscribed intraosseous sarcomata*, both the bone and periosteum can and should be removed for a considerable extent above and below the malignant focus. A fragment is then implanted to fill the gap. We know that a giant-celled sarcoma can be removed by a local operation and the patient survive without local or constitutional recurrence for years. We also know that the same thing is true, in a smaller percentage of cases, however, in the cases of *chondrosarcoma*. In a still smaller percentage of cases the removal of a spindle-cell sarcoma by a local operation without an amputation can be accomplished and the patient live for years without recurrence.

This has led me to hope that the early removal of these neoplasms while they are still circumscribed and encapsulated should give good results. The bone can be removed to a considerable extent with its periosteum, with its musculo-tendinous attachments, and still an excellent functioning extremity be preserved. With this operative outlook early operation will be conceded by the patient, whereas early operation is practically never conceded when amputation is suggested.

In one case (Case 3) I removed  $5\frac{1}{2}$  inches of the upper extremity of the femur for a chondrosarcoma of the trochanter, which originated from a trauma received two years previously. The skiagram showed that the sarcoma involved the trochanter and a portion of the neck and of the shaft for a considerable length downward. The trochanter, neck, head and shaft, with their immediate muscular attachments, were all removed.

An encapsulated chondrosarcoma of the upper end of the tibia followed a trauma (Case 13). It did not involve the articular end of the bone for its entire transverse diameter, but it did involve it fully at the internal tuberosity. All of the diseased tissue was removed, but the epiphyseal line and the portion of the epiphysis close to the fibula were retained.

A fragment was taken from the opposite tibia and inserted at the lower end into the medulla for half an inch, and at the upper end into a pocket in the head of the tibia especially prepared for it. Close to the fibular attachment a nail was inserted transversely in order to prevent the fragment from burying itself too deeply into the cancellated tissue.

The joint was opened during the operation, but its capsule accurately approximated at the close of the operation. The ligamentum patellæ and internal hamstring tendons were fixed close to the surface of the implant by phosphor bronze wire and chromicized catgut. A Buck's extension was then applied to the limb and the latter placed in a wire gauze cast. Primary healing occurred.

The skiagram showed the upper end well embedded in the remaining fragment of the tibia, the lower end in the medulla and osteal regeneration taking place at both ends. This

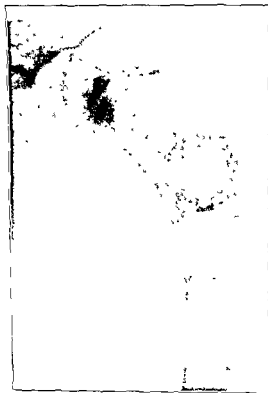


Fig 4 (Case 1) Osteitis fibrosis cystica involving the upper extremity of the humerus for about one third its distance. The articular surface and head appear to be intact.

patient was up and about on crutches in the fifth week. She was examined by me on March 1, when she had about ten degrees of flexion of the knee, voluntary and without pain. She also had power to extend the leg through the ligamentum patellæ attachment. By palpation the tibial end appeared to be of normal size. There was no evidence of return of the neoplasm. The skigram shows that in the soft callus there is as yet but a small bony deposit. A skigram made one year after the operation shows that bone regeneration is progressing well.

The malignant disease had been present so long in these two cases that it is questionable whether there may not be a metastasis in some other portion of the body. I believe, however, that the disease will not recur locally, and we have obtained in both of these cases advantages which we could not have obtained by an amputation.

I believe that this line of work offers a fairly good field in that consent to its performance can be gained so very early in the disease, and in the cases of giant-celled sarcomata good results can be obtained by excision of a portion of the bone without amputation. In order that this work may be made available for those who are willing specially to prepare themselves to perform these operations, I will give a detailed citation of illustrative cases. I feel constrained to say that the work should not be done except by those who have specially prepared themselves for it by doing each and every operation on the cadaver one or more times and by studying the minutæ of the technique of each individual operation. It was the plan we followed and it worked out so well with us that we suggest this course for others to follow.



Fig 5 (Case 1) After removal of diseased bone, a transplant  $7\frac{1}{2}$  inches in length was removed from the opposite tibia and the lower end was driven into the medullary canal of the humerus fragment and held in place with a small wire nail. The upper end of the transplant was placed in the glenoid cavity and the capsule sutured around it.



Fig. 6 (Case 1). Nine months after operation. The upper end of the humerus has been regenerated to a considerable extent, including the tuberosities and the articular surface. The white line a little to the right of the central axis of the new portion of shaft represents the perosteum which was left on the transplant.

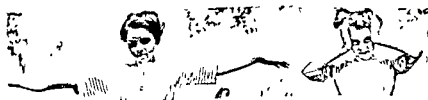
#### OSTEITIS FIBROSIS CYSTICA OF HUMERUS

CASE 1 — Patient — Miss M. C., aged 10, admitted to Mercy Hospital October 17, 1910. The skin

gram in this case (Fig. 4) showed the nature of the disease. The diagnosis was osteitis fibrosis cystica. The bone first undergoes a fibrous degeneration, then there is liquefaction of the fibrous deposits producing small cystic cavities in small areas while a fibrous mass is present in others. This patient had been subjected to mercurial treatment which yielded negative results.

**Treatment** — Operation, October 14, 1910. An incision was made along the anterior border of the bicipital groove, extending down below the attachment of the deltoid. The muscular attachments were separated and retained in position for recognition. The bone was then freed from all of its surrounding tissue leaving the periosteum attached to the bone. Six and a half inches were excised, including the head and epiphyseal line. A  $7\frac{1}{2}$  inch transplant was prepared from the crest of the tibia, the periosteum was retained. This transplant measured  $7\frac{1}{2}$  by  $1\frac{1}{2}$  by  $1\frac{1}{2}$  inch. The medulla of the remaining portion of the shaft of the humerus was scraped out and the transplant inserted for three fourths of an inch. A nail was then passed through a drill hole transversely to prevent it from embedding itself deeper. The upper end of the implant was inserted into the glenoid cavity and the capsule accurately sutured around it. The muscle ends were then attached by an encircling suture around the implant in about their normal anatomic position (Fig. 5). The wound was closed by a deep row of catgut sutures and superficial horsehair sutures. The arm was dressed in abduction at about a right angle to the body. A Buck's extension was applied to the forearm and a 10 pound weight attached with a line running from a pulley. This was to prevent muscular contraction during the period of regeneration which would probably drive the upper end of the bone through the capsule. It was kept on for five weeks.

**Result** — There was complete primary union and at the end of five weeks the humerus appeared on palpation to be as large as the normal humerus. The patient had good voluntary motion. The position to which she could extend her arm when she left the hospital (November 16, 1910, five weeks after operation) showed how much abduction was produced by the deltoid and supraspinatus muscles. A subsequent skiagram shows how completely this bone has regenerated, not only in the part outside of the capsule but also how it has filled in within the capsule.



Figs. 7 and 8 (Case 1). Patient has full power of extension and flexion of the arm, with ability to place her hands on her head.

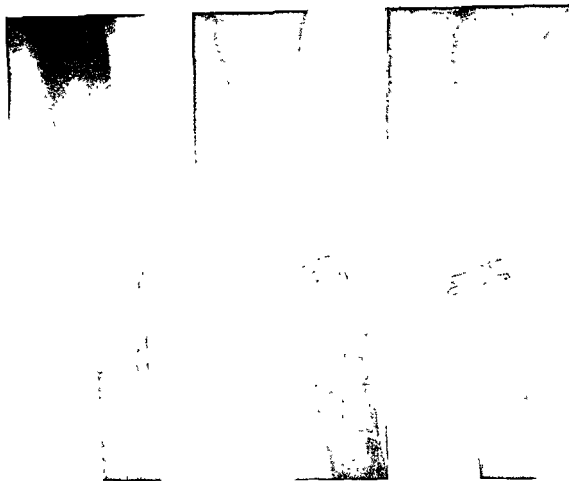


Fig. 9 (Case 2) Ununited fracture of the humerus at the junction of the upper with the middle third

Fig. 10 (Case 2) Skiagram taken shortly after transplantation. The upper end of the transplant is driven into the reamed out medullary canal of the upper humerus fragment, the lower end is placed in the medullary canal of the lower fragment. The sequester was used to give further support to the transplant.

Fig. 11 (Case 2) Skiagram made four months after operation showing that the lower end of the transplant was not fixed and that there was no bony union with the humerus fragment. The upper end of the transplant is firmly united with the bone. The sequester is undisturbed.

It also shows the periosteum remaining intact and not becoming ossified even after this late date. So that it would appear that the periosteum on the transplant is a detriment rather than an advantage. Serial skiagrams of this case were taken every few weeks showing the condition, so that a careful study could be made of the progress of bone development. Extension from the living periosteum below was the most important next from the medulla. This rapidly shot upward around the transplant to the capsule of the joint (Fig. 6).

The progress was then more slow. She can now abduct her arm to a right angle in extension and flexion is likewise complete so that she does not

know that any serious operation has been done on her arm so far as its usefulness is concerned (Figs. 7 and 8).

By studying the skiagram (Fig. 6) one can observe the stages of reproduction very well. At the end of five weeks, on palpation, the humerus appeared to be as large as a normal humerus, although the skiagram showed small calcareous deposits only here and there. The development of compact bone proceeded along definite lines — from extensions of the periosteum, from the medulla, through the

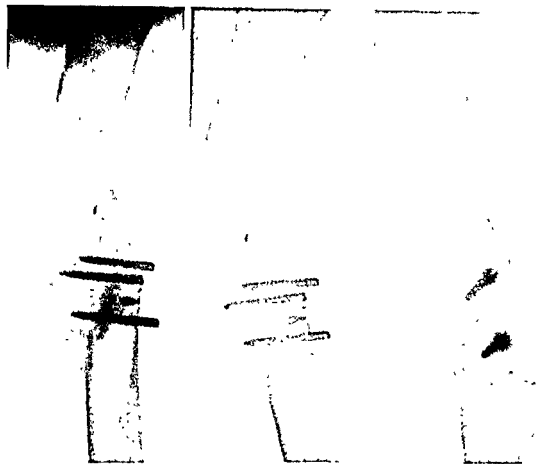


Fig. 12 (Case 2). Skiagram taken shortly after second operation. The lower end of the transplant was replaced in its bed and fixed by means of three screws. Two screws held the transplant in place against the lateral wall of the medullary canal, the third screw overrode the transplant, holding it down.

Fig. 13 (Case 2). Skiagram taken six months after second operation, showing complete fracture of the transplant.

Fig. 14 (Case 2). Skiagram made one month after third operation. The long thin shadow on the right is the new transplant, which is secured to the lower fragment by means of two screws. The first transplant, consisting of two pieces, is on the left.

implant, up to the capsular attachment and into the joint, as shown in the last skiagram picture, taken nine months and some days after the operation (Fig. 6).

Here also can be observed the evolution of the tuberosities at the points of muscular fixation. Again it will be noted how the transplanted periosteum remained as a white line for seven months after the implantation, and that it was an apparent detriment to the production of bone. It was finally involuted

by bone formed from the new periosteum around the new formed callus.

This shows how completely the humerus can be regenerated and how perfectly function of the extremity can be restored (Figs. 7 and 8) in cases in which formerly amputations were made.

#### UNUNITED FRACTURE OF HUMERUS

CASE 2.—T. L., male, aged 24, January 20, 1912, sustained a compound comminuted fracture at the junction of the upper and middle third of the right



Fig. 15 (Case 3) Chondrosarcoma involving the upper extremity of the femur but not the articular surface of the bone

humerus by being struck on the arm by the limb of a falling tree. So far as could be ascertained from the patient (he spoke little English) the wound discharged for three weeks. Reduction of the fracture is said to have been attempted immediately by manipulation and the arm dressed in a wooden splint. No union after three months (Fig. 9).

The skiagram showed the fracture at the point mentioned above with a sequestrum about one inch in length lying between the main fragments of the shaft. There was no apparent effort at union. The patient could not use his arm because of this false joint.



Fig. 17 (Case 3) Skiagram made shortly after operation. The upper end of the transplant is in the acetabulum. The lower end is in the medullary canal of the femur. The upper nail marks the point where the muscles are fixed around the transplant. It was this nail which caused the fracture of the transplant. The small fragment above and to the left is secured to the main fragment by means of phosphor bronze wire sutures. Regeneration of bone is already taking place.

**Treatment** — This man was operated on twice. The first operation was performed April 16th. A longitudinal incision between the deltoid and biceps muscles exposed the fracture freely. The lower end of the upper fragment was adherent to the skin. It was carefully freed, avoiding the musculospiral nerve and the vessels. A band of firm connective tissue between the fragments, which had prevented union, was cut. The lower fragment was free. The sequestrum was not removed. The medullary cavity of the upper and lower fragments was enlarged with the reamer for a distance of one inch preparatory to inserting a bone transplant. A piece of bone five inches long by  $\frac{3}{8}$  x  $\frac{3}{8}$  of an inch was removed from the crest of the patient's right tibia in the usual manner and shaped at the ends with bone cutting forceps to fit the cavities previously prepared in the upper and lower fragments of the humerus. This transplant was first inserted and then driven into the cavity in the upper fragment and then slipped into the lower fragment, the



Fig. 16 (Case 3) Specimen removed at operation and split into halves. The disease appears to involve mainly the greater trochanter, the upper surface of the neck, and the bone below the trochanter. The head is apparently free from disease.



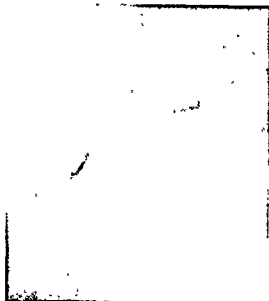


FIG. 1. Case 1. Skinning and repair of the arm. There is a very extensive laceration of the arm and hand. The wound is very deep and the patient is in great pain. The operation is performed.



FIG. 2. Case 1. After removal of a piece of the arm. The patient is operated on under ether anesthesia. The patient is in great pain. The operation is performed.

sequestrum being made to serve as a base for the transplant. Two phosphor bronze sutures united the lower fragment and gave additional support to the transplant. Care was taken to unite the muscles of the arm. The skin was sutured with horsehair, dusted with iodoform dust and sealed with collodion gauze. A plaster cast and gauze dressing was then applied. The elbow was flexed at right angles to the chest and the hand and shoulder and arm were encased in a plaster of Paris cast. The hand was free. The wound of the leg was closed with suture and horsehair dusted with collodion gauze and a plaster cast and gauze dressing put over it. No drain. All stitches were removed at the end of two weeks. The cast was removed at the arm (Fig. 1).

Patient returned in August because of failure of union. He had been at work as a laborer and polishing metal and woodwork for over three months constantly using the hand for the affected arm. He wore a plaster cast all of the time but because of the use of his hand and arm to some extent the cast did not give him the needed support. The skigram showed that the transplant had become firmly united with the upper fragment but not with the lower. It apparently was freely movable in the cavity in the lower fragment. The sequestrum was undisturbed (Fig. 12).

The second operation was done August 1, 1911. A longitudinal incision to the outer side of the old

transplant exposed the site of the fracture. The cavity of the arm was closed. The patient was placed in the same position as before. The patient was in great pain. The operation was performed.

It was not necessary to transplant another fragment to the site of the fracture. The cavity of the arm was closed. The patient was placed in the same position as before. The patient was in great pain. The operation was performed.

The wound was closed with deep catgut sutures and horsehair sutures dusted with iodoform dust and sealed with collodion gauze. A 5 per cent carbolic gauze dressing was applied and over all a plaster cast immobilizing the shoulder, arm and hand completely.

About five months after the second operation the patient again fractured his arm in the middle of the transplant. He was carrying a large, heavy

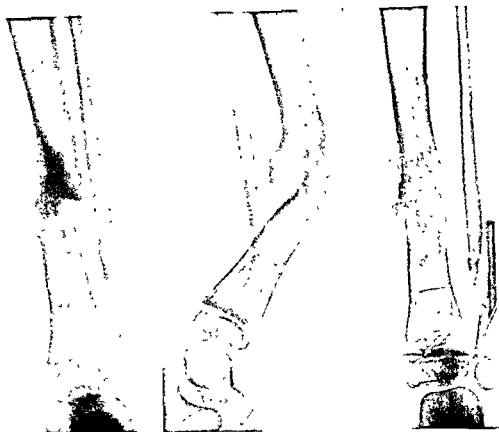


Fig. 21 (Case 4) Antero-posterior view showing little deformity except of fibula. The lines of fracture are apparent, although some union of the tibia seems to have occurred. The fibular fragments are widely separated.

Fig. 22 (Case 4) Lateral view, showing how the upper fragments of the fibula and tibia rest on the lower fragments, forcing them downward and forward, thus producing the angular deformity.

Fig. 23 (Case 4) Two pieces of bone were removed from the opposite tibia. One piece was implanted into the tibia in the usual manner and after the usual preparation. The second piece was contacted with the upper fibular fragment and embedded partly in the lower fragment.

leather couch with a fellow-workman. The latter dropped his end and when it struck the ground the full force of the blow was imparted to the patient's humerus and the fracture occurred (Fig. 13).

A third operation was performed and the second transplant was inserted into the humerus. The bone was again exposed from the external aspect of the arm and both fragments were grooved on the lateral aspect to receive the transplant. It was firmly wedged into the upper fragment and fixed to the lower fragment by means of two screws (Fig. 14). The first transplant was not removed because it was felt that it might still prove of some value in favoring the regeneration of bone and the occurrence of new union. The arm was again immobilized in a body cast which the patient is still wearing.

#### MALIGNANT NEOPLASM OF FEMUR

CASE 3 — Mr. N., age 41, admitted to Mercy Hospital September 14, 1911. In August, 1909, while riding a bicycle down an incline, he suddenly lost control of his wheel and fell, striking the curb on his left hip. Got up and walked with some difficulty and had severe pain for two or three hours following the accident. In September, 1909, while at work, he received another injury to his hip. Had sharp shooting pain in the lumbar region. Pain was very acute until the next day, when it changed to a dull ache. Patient when sitting down would lean forward and to the right side. When getting up would straighten slowly on account of the pain in the hip. When he stooped down he would at times have to crawl up on his limbs with his hands, as does a child with tubercular spondylitis. This ache in



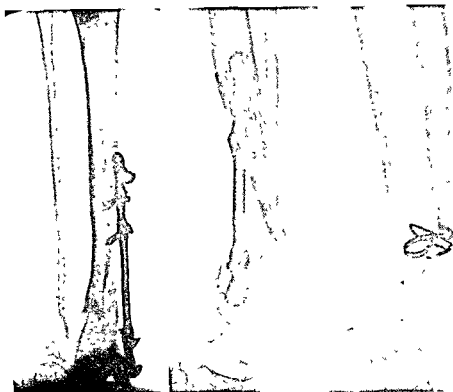
Fig. 24 A Skiagram made five months after the first operation, anterior view. The fibula is intact, with firm bony union between transplant and fragments. The tibia apparently is also united but reference to B (lateral view) shows that the transplant has been fractured. C Last skiagram made four months after the second operation, when a second transplant was placed in grooves made on the anterior surface of the tibia fragments. The shadows of both transplants may be distinguished, that of the second superimposed on the first. (Case 4)

the hip continued until March, 1910, when the trouble became more annoying. Whenever patient walked a great distance, the hip would become very painful. Since that time has used a cane and a crutch. Pains have been increasing in severity so that now he can walk only about half a block, when he becomes very greatly fatigued. Patient walked with the leg in abduction and has very limited motion at the hip joint. In February 1911, he was treated with electricity and massage without any relief, and following this took injections of sodium cacodylate without result. Patient at this time began to notice shooting pains in his left limb, coming on especially at night. In January of this year had two weeks of incessant night headaches, lasting from bedtime until morning. Was very restless and slept poorly. Has no cough, no temperature with present trouble or preceding the present trouble. Has lost twenty four pounds in last year. Had lues 18 years ago.

**Examination** — The skiagram (Fig. 15) showed that sarcoma involved the trochanter and a portion of the neck and of the shaft for a considerable length downward.

**Treatment** — The trochanter, neck, head and shaft with their immediate muscular attachments, were all removed (Fig. 16).

A fragment of bone  $5\frac{1}{2}$  inches in length was taken from the opposite tibia and inserted into the medulla of the femur at the distal end and the proximal end was inserted into the acetabulum and surrounded by the capsule. A nail was driven through a drill hole in the fragment at the trochanteric level to which the muscular attachments could be fixed thus preventing motion of the fragment and at the same time securing the future function of the leg. Later in the operation, when pressure was put on, the bone split at this point. The fragments were immobilized by a circular wire and catgut ligature. The muscle ends were drawn



Figs 25 and 26 (Case 5) Skiagram made after second open operation. The Lane plate was attached to the tibia fragment, but did not result in bony union. The antero posterior view might lead one to believe that union had occurred. The lateral view shows marked displacement and separation of both fragments.

Fig 27 (Case 5) Skiagram made after the third open operation done in Copenhagen. The ends of the tibia fragments were wired together, but with the same result as before, bony union failing to take place.

around the shaft in various positions approximating as nearly as possible their normal location. The wound healed per primam. Extension was applied to maintain the full length of the thigh during the process of regeneration.

The skiagram (Fig 17) shows the evolution of bone from the medulla and from the periosteum of the living bone, making a bony involucrum around the soft callus.

In eight weeks the upper end of the femur, judging by external manipulation, appeared to be of full size. The skiagram, however, showed only here and there bony deposits. Regeneration is taking place, as can be seen in the most recent skiagrams taken three months after the operation—between the split fragments and well up into the acetabulum. The patient is going about on crutches and suffers but little pain. He is not permitted yet (3 months after operation) to put any weight on his leg (Fig 17).

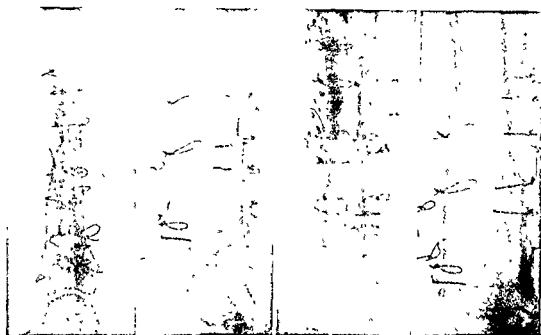
The extensions were removed at the end of three months. It appeared to me after operating in this case that it would have been a good plan to use

bones from the embryo to surround the compact bony tissue that was taken from the patient's tibia, because this might stimulate regeneration or act of itself in the reproduction of bone.

One year after the operation the patient was able to abduct, adduct, swing and rotate this leg. He could also cross it over the other leg when seated. Up to this time, he had not been permitted to place any weight on the leg. The skiagram (Fig 18) shows that bone regeneration is progressing satisfactorily.

#### UNUNITED FRACTURE OF TIBIA AND FIBULA

CASE 4—G S, male, aged 5 years, entered hospital because of an old ununited fracture of the tibia and fibula at about the junction of the middle with the lower third. Several attempts had been made to secure union, without success. The fracture is believed to have been of congenital origin. The fracture of the fibula is lower than that of the tibia. No shortening of leg but foot is smaller than its fellow.



Figs. 28 and 29 (Case 5) Skiagram taken four months after operation. The bones are in perfect alignment, the leg plumb. The antero-posterior view shows that bony union is progressing rapidly. The lower end of the trans-plant in this case was driven down through the epiphysis of the lower fibular fragment. The upper end was contacted with the fibula laterally. The tibia fragment was driven into the medullary canal above and down through the epiphysis below. Phosphor bronze wire sutures were used to secure additional fixation.

Figs. 30 and 31 (Case 5) Skiagram taken six months after operation showing that regeneration of bone has progressed rapidly although there is no effort at union between the old tibia fragments. The regeneration has taken place from the tibia to the trans-plant. The leg is solid and is growing in length.

*Examination* — The skiagram antero posterior view, shows distinctly that the fibular fracture is oblique and that the fragments are separated for some distance. The tibia is broken square across and union has apparently taken place with the production of some callus. The lateral view shows that this union is only an apparent one and that there is considerable angulation of the fragments. The lower end of the upper fragment now shows a considerable callus formation. This boy has not been

able to walk although he has attempted to put weight on this leg. The result is this deformity (Figs. 19-22).

*Treatment* — A typical transplantation was done. A longitudinal incision over the crest of the tibia about eight inches in length exposed both bones. The ends of the tibular fragments were only slightly covered by granulative tissue. The ends of the tibial fragment were covered by a considerable amount of callus and cicatricial tissue. There was no evidence

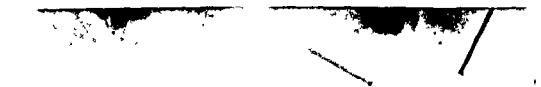


Fig. 32 (Case 6) Destruction of a considerable portion of the anterior portion of the inferior maxilla by a gun shot wound. Some of the shot can still be seen in the bone. This picture was taken with the chin of the patient resting on the plate, the light coming from above and in front.

Fig. 33 (Case 6) A small piece of the tibia was removed, fashioned to fit the contour of the jaw and nailed in place with two small wire nails. The normal curve of the jaw has been restored.

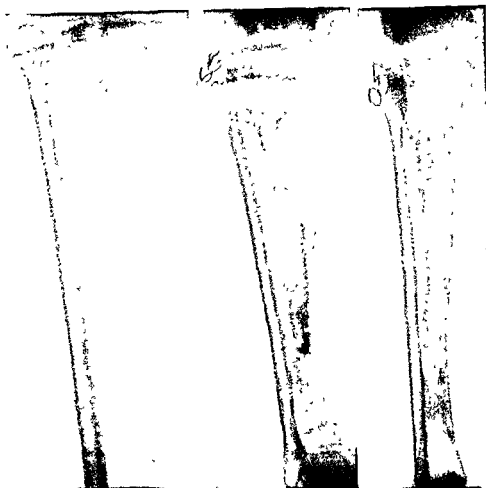


Fig. 34 (Case 7) Destruction of most of the shaft of the tibia by osteomyelitis. The epiphyses and articular surfaces of the bone were not affected.

Fig. 35 (Case 7) Skingram made three months after transplantation of a six inch fragment taken from the opposite tibia and contacted with spicules of the bone remnants of the tibia shaft both above and below. Bone regeneration is taking place. The head of the tibia it will be noted, has been transplanted, after removal of its epiphyses into the side of the tibia to maintain the length of the leg.

Fig. 36 (Case 7) One year after operation with almost complete regeneration of the shaft of the tibia. The small hole near the upper extremity of the bone identifies the picture as being of the same leg as the other pictures of the series.

of sepsis. The ends of both bones were carefully freed from the new formed fibrous tissue and freshened until they bled. The tibial fragments were reamed out for a distance of about an inch and a half. The lower fibular fragment was reamed out for a distance of about half an inch. The upper fibular fragment was not reamed out because of its small size.

The opposite tibia was then exposed at its middle portion for a distance of eight inches and two pieces of bone with the periosteal covering were removed

from its crest with chisel and saw in the usual manner. One piece measured about four inches in length by  $\frac{3}{4}$  x  $\frac{3}{5}$  and the second piece about two inches in length by  $\frac{1}{4}$  x  $\frac{3}{8}$ . The wound was then closed with deep catgut and superficial horseshair sutures dusted with bismuth subiodide powder and sealed with collodion. A plain sterile dressing was applied. The bone fragments were carefully held with sequesterum forceps and not allowed to come in contact with anything.

The larger fragment or implant was then inserted



Fig. 37 (Case 7). Photograph taken four years after the operation. The leg is plump and of normal size and shape. The foot is placed square on the ground.

into the tibial fragments which had been previously reamed out to the size of the transplant so as to contact firmly with both fragments. The smaller implant was inserted into the lower tibular fragment in such a manner that a firm lateral contact of the implant with the upper fragment was secured. The normal conformation of the leg was thus restored. There was no sign of deformity. The wound was then closed in the same manner as the opposite leg. A 5 per cent carbolic gauze dressing was put on and a well fitting plaster of Paris cast was applied extending from the toes to the groin. As soon as it was hardened it was cut with a thigh saw (Fig. 23).

Four weeks later the cast was removed to take out the stitches. There was fairly firm union of both tibia and fibula. The cast was reapplied. Eight weeks after the operation the boy was allowed to leave the hospital.

He returned six months after the operation for re-examination. The fibula was solidly united but the tibia appeared to be fractured at the site of the former fracture. A second operation was done. The fibula was firm but the transplant in the tibia had fractured. It could easily be differentiated from the tibia itself by its compactness. The fracture was undoubtedly the result of too early use of the limb. The upper and lower ends of the transplant had firmly united with the tibia.

A trough was chiseled out of the tibia above and below the fracture  $5\frac{1}{2}$  cm. long and 1 cm. wide and deep. Into this trough was firmly fitted a transplant taken from the opposite tibia in which the defect caused by the removal of the first two transplants had been filled in completely by new bone. Deep

plain catgut and horsehair skin sutures closed the wound. Bismuth subiodide colloidal gauze and 5 per cent carbolic gauze dressings were then applied. Over this a plaster of Paris cast, extending from the toes to the middle of the thigh, completed the dressing. The cast was cut as is our custom. This cast will be left on undisturbed for three months (Fig. 24).

**CASE 5.**—M. J. male, age 8. Came to hospital because of ununited fractures of tibia and fibula of left leg. When the baby was 7 months old the mother while bathing him, noticed that the left leg was bowed more than the right. She grew anxious about the deformity and consulted a doctor who said the lower third of the tibia was fractured. The leg was put in wooden splints. The splints were kept on for five months. When the child was one year old he began to walk and a brace was put on the leg. When he was seventeen months old he was walking around without his brace and fell and at this time the fibula was fractured. The leg was again dressed with splints. The splints were removed at the end of six weeks but there was no bony union. The doctor advised taking the patient to a specialist who put on a plaster cast and had the child up and around. The plaster cast treatment was kept up two years, the cast being changed at intervals of six weeks. When the child was three and one half years old an open operation was performed and aluminum tubes inserted in the medullary canals of the fragments of the tibia. Three months after the operation, the leg was X rayed and non union was still present. At this



Fig. 38 (Case 8). Fracture of anatomic neck of humerus with dislocation of the head of the bone into the subglenoid space.

time the parents brought the child to a New York specialist who put on a brace and advised the Bier treatment by a rubber constricted above the knee twice daily one hour at a time. The brace and Bier treatment were kept up for a year without result. A Lane plate operation was performed with equally bad result. The plates were removed. One year ago the child was taken to Europe and the third open operation was done. This time the ends were wired by a surgeon in Copenhagen with the same result — non union (Figs 25-27).

**Examination** — The boy is unable to use his leg at all because of lack of continuity of the tibia and fibula because of an old fracture, probably of about seven years' standing. There is no deformity when the leg is lying flat on the table but there is a marked shortening of the leg slightly over four inches and the foot is considerably smaller than the fellow, the result of disuse. The skiagram shows that there is a fracture of both bones of the leg with wide separation of the fragments. The epiphyses appear to be intact.

**Treatment** — An incision about eight inches in length was made on the anterior aspect of the leg over the seat of the fractures and the bones were exposed carefully. It was evident that a bone implant could be inserted into the tibia but that in the case of the fibula a lateral approximation or contacting would have to be made with the upper



Fig 40 (Case 8) This skiagram was taken about three months after the operation and shows that a new head for the humerus is being built by the osteoblasts from the shaft of the bone which passed into the Haversian spaces in the head of the bone

fragment but that an implantation could probably be made in the lower fragment.

The opposite tibia was exposed and two pieces of bone were carefully removed from its crest. One piece measured five inches in length by  $\frac{3}{4}$  by  $\frac{3}{4}$ , the other piece was four inches in length by  $\frac{3}{4}$  by  $\frac{1}{4}$ . The tibial fragments were prepared for the implant. The upper fragment was reamed out the medullary cavity being enlarged to receive the transplant but the fragment was so short, only half an inch above the epiphysis, that the transplant had to be driven down into it as can be seen in the skiagram. The upper end of the transplant was driven up into the lower end of the upper fragment. In the case of the fibula, the upper fragment could not be reamed out because of its small size. Therefore the transplant was driven down through the epiphysis of the lower fragment and a lateral contacting or approximation made with the upper fragment so that the transplant would serve as a splint for the fibula. Approximation was secured with encircling loops of phosphor bronze wire, as is seen in the skiagram.

The wounds in both legs were closed carefully with chromic catgut in the deeper layers, and with horsehair to approximate the skin edges. The surface was dusted with bismuth subiodide and the wounds sealed with collodion gauze. A 5 per cent carbolic gauze dressing was then applied, over this a sterile gauze roller was wound and then plaster of Paris casts were put on both legs, in the injured leg extending well up on the thigh, in the uninjured leg up to the knee. The cast on the right leg was removed after two weeks and the stitches removed. After four weeks the cast was removed from the



Fig 39 (Case 8) Skiagram taken shortly after the operation, showing that the anatomic relations of the shoulder are normal. The head of the humerus is in the glenoid cavity. The nail secures it to the shaft. There is not much formation of new bone here. The very light shadows show that the rays passed through mostly dead bone





Fig. 41 (Case 8) This skiagram was made four months after the operation when the nail had to be removed. Bone regeneration is still taking place.

left leg and the stitches removed. The cast was reapplied and was worn continuously for four months. After six weeks it was evident that firm bony union was present. The boy could raise his foot for the first time since the injury occurred about seven years before this last operation (Figs. 28 and 29).

A skiagram taken six months after the operation shows that the condition is progressing rapidly.

Firm bony union has taken place in both bones in the transplanted fragment but there is no effort at union between the old tibia fragments although they are in accurate approximation and the regeneration of bone is proceeding satisfactorily. This case demonstrates that it is absolutely essential that there is contacting between the trans-plant and the bone, but that this need not necessarily be in the center of the bone, a lateral contact is sufficient, provided that it is securely maintained. The epiphyses are not injured by the driving of the transplant through them. The leg is growing in length, although it will probably never reach the same length as its fellow, because it was about four inches shorter at the time of operation (Figs. 30 and 31).

#### DEFECT IN LOWER MAXILLA

CASE 6 — R. H., aged 27, about six months ago sustained a severe injury of his chin by the discharge of a shotgun. The bone was shattered and sepsis followed, which finally resulted in necrosis and loss of the mental portion of the maxilla. His chin is flat and considerably marred by a badly retracted scar (Fig. 32).

Examination showed that there was no longer any evidence of sepsis. The wound had healed completely.

*Treatment* — We planned to remove from the patient's tibia a piece of bone of sufficient size to fill in the defect in the mental portion of the inferior maxilla after it had been shaped properly. The incision in the chin was made underneath the chin along the margin of the maxilla, curved in outline and measuring about two inches in length. The



Fig. 42 (Case 9) Fracture of the neck of the humerus, with upward displacement of the shaft. The skiagram is misleading and would not aid materially in making a diagnosis of the fracture.

Fig. 43 (Case 9) Another view of the same shoulder, showing plainly both the fracture and the dislocation.

Fig. 44 (Case 9) Skiagram taken shortly after the operation, showing that the fragments have been approximated in the normal position and fixed by means of a nail driven from the shaft into the head. The head of the nail was nipped off and it has receded slightly into the bone.

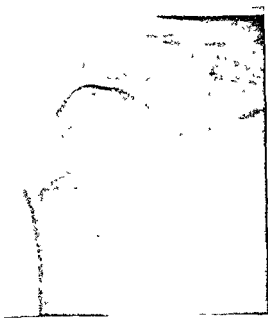


Fig. 45

Fig. 47

Fig. 45 (Case 10) The arm is slightly abducted. The fracture is evident, but the head appears to be in the glenoid cavity which physical examination shows was not the case.

Fig. 46 (Case 10) Another view of the same shoulder, with the head appearing to be placed well in the glenoid cavity. In this case a diagnosis of a fragment being torn

Fig. 46

Fig. 48

out of the bone might be made instead of a fracture of the neck.

Figs. 47 and 48 (Case 10) Two skiagrams taken about four weeks after the operation. The head of the bone is resting in the glenoid cavity. The two fragments which were fixed in position by two wire nails are apparently united.



Fig. 49 (Case 11). Old fracture of the anatomic neck of the femur, with absorption of the head of the bone. This skiagram was made four months after the operation. The nails are still in place and there does not appear to be any absorption of the bone around them. The trochanteric fragment transplanted to serve as a temporary head has united with the neck of the bone and a new head has formed.

field was exposed easily and freely. There was perfect asepsis so that we felt that the bone graft or implant would live. The edges of the maxilla on either side of the defect were freshened, care being taken at all times not to injure the remaining alveolar portion of the jaw. The edge of the right tibia was then exposed in the usual manner and a piece of bone about one inch and a half in length by  $\frac{1}{2}$  inch by  $\frac{1}{8}$  was removed. This was then shaped carefully to fit into the defect in the jaw and to give the chin the normal convex outline. This was easily done with chisel and bone cutting forceps. The implant was then laid in the bed prepared for it and approximated with the jaw on either side was maintained by means of two small wire nails driven from the edge of the implant backward into the ramus of the jaw, thus holding it securely in place. The wound was then sutured in the deeper layers with catgut and the skin with horsehair. Bismuth subiodide powder and a colloidal gauze dressing completed the primary dressing. This patient progressed very nicely until two months after the operation, when he had an acute attack of appendicitis. The appendix was removed. Recovery was uneventful.

Later he had his nose operated on, and for some reason sepsis occurred and he died about four

months after the original operation on his chin. The last skiagram taken shows that the bone implant is in position and leads us to believe that the final outcome of the case would have been most satisfactory (Fig. 33).

#### OSTEOMYELITIS OF TIBIA

CASE 7 — G. W., aged 6, admitted to Mercy Hospital February 8, 1909. About nine months previous to her admission to the hospital the first time she suffered from an acute osteomyelitis with a necrosis of the major portion of the shaft of the tibia, leaving the epiphyseal lines at the knee and ankle intact with a small spicule of bone extending downward and upward (Fig. 34). The surfaces were ulcerating and covered with granulation tissue.

Treatment — First operation, February 9, 1909, consisted in curettage and removal of the spicule of bone, loosening the flaps from the margin and approximating them accurately for the entire length of the scar tissue that had been made previously in the removal of the sequestrum. The periosteum for over 3 inches of the middle of the bone had been destroyed entirely. The contraction of the muscles of the leg was producing luxation of the upper end of the fibula. The upper end of the fibula was removed and a niche made in the external surface of the tibia deep enough to admit the fibula to the shaft side of the epiphyseal line so that the epiphysis of the tibia was to contribute to the growth of the fibula subsequently. The upper fibular epiphysis was removed. The upper end of the fibula was wired in position in a cavity prepared for it in the head of the tibia and primary union occurred and a rapid healing of all of the excavated and approximated zone in the tibia. The patient returned to the hospital April 26, 1909. The suppuration had ceased entirely and the wound was in good condition. Second operation, April 28, 1909. An incision  $6\frac{1}{2}$  inches long was made to the outer side of the old scar line and the spicule of the remaining portion of both ends of the tibia exposed. The periosteum was freed from the external anterior surface above and below. A triangular fragment of bone  $3\frac{1}{2}$  inches long by  $\frac{3}{8}$  by  $\frac{1}{2}$  by  $\frac{5}{8}$  inch was taken from the crest of the right tibia and transplanted into the cavity prepared for it where the shaft of the left tibia had necrotized. The periosteum at the upper and lower ends was applied around the margins of the transplanted fragment and chromicized catgut encircled both bones to insure continued apposition (Fig. 35).

Result — There was a primary union of the soft parts and a rapid thickening of the entire area occupied by the transplant. In three months she was permitted to walk with a cast and the skiagram taken eleven months after the operation (Fig. 36) shows complete absorption of the transplant and the development of the bone to about the normal size of the tibia. The round opening in the upper end of the tibia identifies it as the same tibia throughout the pictures. So perfect is the reproduction that



Fig 50 (Case 12) Fracture of the tibia and fibula with non union of the tibia. The fibular fragments have reunited.

Fig 51 (Case 12) Skiagram made shortly after the operation, showing the transplant in the tibia and the formation of new bone around the fragments.

Fig 52 (Case 12) Skiagram taken six weeks after the operation, showing the formation of a considerable quantity of new bone, so that the tibia appears to be solid. The transplant is still in evidence.

one might doubt the skiagrams were it not for this opening. A picture of the girl taken April 1912, shows how completely a bone can regenerate if the transplant is carefully contacted so that there is a perfect osseous fragment. It further shows that although the periosteum of the major portion of the shaft of the tibia had been entirely destroyed the bone reproduction nevertheless proceeded to the formation of a new shaft. Perfect functional and anatomic result (Fig 37).

#### FRACTURE OF SURGICAL NECK OF HUMERUS WITH LUXATION OF HEAD AND NON-UNION

CASE 8 — Mrs M. K. aged nineteen, admitted to Mercy Hospital September 10, 1911. June 29, 1911 patient was thrown from an automobile. Does not know how she landed nor whether she was unconscious. She was lying on her right side, with her arm under her, and was assisted to her feet by being picked up under both arms, when she felt a pain in the right shoulder-joint which was increased on motion. She had shooting pains down the arm. After the accident the arm was put in a De Sault splint and a diagnosis made of dislocation. This was changed later to fracture of the neck. An X-ray picture taken a week later was said to show nothing

The arm was left in the original position for three weeks, when passive motion and massage were begun. She can now abduct the arm and has some deltoid motion, but cannot raise it with the elbow flexed.

**Examination** — Skiagram showed fracture of the neck of the humerus with displacement of the head out of the glenoid cavity into the subglenoid space. On examination it was found that she can abduct the arm four inches from the body and she has some deltoid motion but cannot raise it with the elbow flexed (Fig 38).

**Treatment** — Under ether anesthesia the shoulder-joint was opened by an incision five inches long, parallel to and in the anterior portion of the deltoid. The glenoid was freed from the remnants of the capsule and the cartilage exposed. The head of the humerus was then freed from its attachment in the luxated position and brought out on the table. The fractured end was freshened and it was prepared for replacement in the glenoid. The fractured edge of the humeral neck was then freshened so the cancellated tissue clearly showed. The head was then replaced in the glenoid cavity and nails were driven through humerus well into the head. The first skiagram shows the bloodless head in position, and



Fig. 53 (Case 13). Fracture of tibia and fibula, with non union of tibia after wiring.

Fig. 54 (Case 13). Skiagram made shortly after the transplantation of a fragment of bone into the tibia.

Figs. 55 and 56 (Case 13). Lateral and antero-posterior views taken 26 months after the operation, showing complete restoration of the shaft of the tibia.

the second skiagram shows the head fully regenerated. There was primary union and motion is rapidly returning. The joint is practically painless. Excellent result (Figs. 39, 40 and 41).

#### FRACURE OF SURGICAL NECK OF HUMERUS

CASE 9 — Miss L. S., aged 10, admitted to Mercy Hospital September 23, 1910. Patient fell from a horse September 10, landing on her left shoulder. She got up and walked to the house. A doctor was called and by the time he came the shoulder was greatly swollen and a diagnosis was not made. Following the injury the patient did not move the arm much, but held it flexed upon her abdomen. A bandage was applied and the arm kept at rest. Whenever the arm or shoulder was moved it caused her severe pain in the shoulder. The patient could move the arm forward and backward, but she could not abduct it.

Examination — This disclosed the physical disability already mentioned. The skiagram showed a fracture of the neck of the humerus with upward displacement of the shaft of the bone (Figs. 42 and 43).

Treatment — An incision was made over the joint and the fractured bones exposed. The lower frag-

ment overrode the upper fragment about one half inch, and it was necessary to remove about half of an inch before it could be reduced. The epiphyseal line was not disturbed. After bringing the bones in apposition they were secured by a nail driven from the outer side of the upper end of shaft through it and into the head. Skin sutured by horsehair and a cast applied (Fig. 44).

Result — Primary union of soft parts and bone. Perfect functional result.

#### UNUNITED FRACTURE OF ANATOMIC NECK OF HUMERUS

CASE 10 — H. B., male, age 27, came to hospital on account of inability to use left shoulder joint. August 4, the patient was flying his biplane when something went wrong with the engine. He shut it off and volplaned to earth. He landed near a barb wire fence and ran directly into it. The machine was stopped by the fence but he and the gas tank went on catching his legs on top wire of fence. He struck a chicken coop and fell to the ground, landing on his left shoulder and pieces of the coop and gas tank were on top of him. He was unconscious for fifteen minutes. When he regained consciousness he had an aching pain over upper third

of humerus; was unable to move the arm. No pain in shoulder. Few scratches about head and back and other minor superficial injuries. He was taken to a hospital where the surgeon diagnosed a backward dislocation of the head of the humerus and a double fracture of the scapula. He was anesthetized and when he woke up the shoulder was firmly and tightly strapped with adhesives, so tight he could scarcely breathe. Over this was placed a wire screen cape. Arm was in a sling with elbow at right angles and forearm midway between pronation and supination.

Three weeks later the adhesive was removed and the shoulder appeared to be normal. The doctor then strapped the scapula firmly with adhesive and the upper arm was held tight to thorax with adhesive, elbow and hand were free. Three weeks later he was examined again and this time there was a bone protruding just behind shoulder joint which was diagnosed as a fracture of the acromion process and laceration of deltoid muscle. Advised massage. Cannot move shoulder joint in any direction without causing him great pain. Arm is held firmly to side of thorax. Tingling in hand off and on for a month.

The skiagram, although taken in seven different positions, did not in any of them indicate that the head was away from the glenoid articular surface, but a physical examination showed clearly that the head rested on the posterior surface of the glenoid cavity under the spine of the scapula. This shows how deceptive a skiagram may be. At the operation the physical findings were confirmed.

**Examination** — The skiagram showed that there was a fracture at the surgical neck of the humerus through the tuberosities but did not show the subluxation of the head of the bone and rotation forward so that the shaft was behind the head. The upper end of the fractured shaft appeared to be covered by callus. There was no evidence of fracture elsewhere. Motion elicited considerable pain. There was little deformity merely a slight flattening of the shoulder and a little shortening of the upper arm. Seven skiagrams were made of this case and none showed the exact deformity as did the physical examination (Figs. 45 and 46).

**Treatment** — The shoulder joint was exposed by a longitudinal incision at the posterior margin of the deltoid, the fibers of the muscle being separated. The head of the bone was free. There had also been a longitudinal fracture through the head fragment making an inverted T (*L*) fracture of the upper extremity of the humerus. The head was still alive, but was of abnormal size and conformation because of a malposition and bony union of the head fragments. Attempts at reduction failed absolutely. Therefore, the smaller or outer of the two fragments was chiseled loose and reduction again attempted but without success. The large fragment was detached and then removed entirely. Its articulating surface was smooth and shiny. With the fragment out on the table the fractured end was then freshened likewise the end of the shaft. The head fragment



Fig. 37 (Case 14) Antero-posterior view of sarcoma of upper extremity of tibia, not involving the joint.

was then replaced in the glenoid cavity and by means of firm traction on and outward rotation of the arm the two fragments were finally approximated and maintained in position by means of two wire nails driven through the shaft into the head. The arm was held in extreme abduction. Plain catgut sutures closed the deeper layers of the wound and horsehair was used to approximate the skin edges. No drain. The strictest asepsis was maintained throughout the entire operation.

A plaster of Paris cast was then applied extending over both shoulders, across the back and chest with the injured arm in extreme abduction and flexed at the elbow so that the forearm was elevated to right angles. Both arms were fixed in this crucial position, the cast embracing the body in front and behind extending from the neck to the costal margin and fixing both arms resembling the fixation cast that is applied to the hips after the reduction of a double congenital dislocation.

The skiagram taken one month after the operation shows that union has taken place. The line of



Fig 58 (Case 14) Another view of the same case also showing the location of the tumor. Here too there is evidence that the articular surface is not involved.

fracture is not apparent. The wire nails are still in situ. The final photo shows that the full conformation of the shoulder is restored (Figs. 47 and 48).

#### FRACTURE OF PELVIS AND NECK OF FEMUR

CASE 11 — F. H. S., age 40. March 29, 1911, was injured in a railroad accident and was taken to the hospital where he remained for three weeks, but nothing was done except to keep him in bed. When he began to walk, his right hip was very painful, and the right leg was shorter than the left. He was advised to use crutches and keep the right foot off the ground. A Thomas hip splint was put on but no improvement followed. There was no pain except when stepping on the foot. Can abduct and adduct, and has internal and external rotation and flexion, but is unable to flex thigh on abdomen when the leg is extended, nor can he bear his weight on the leg because it gives way. He cannot abduct his thigh when the leg is flexed. The leg is 3 cm. shorter than the other.

Examination showed a fracture of the pelvis and fracture of the neck of the femur with absorption of all the head, except a small piece (Fig. 49).

Treatment — In this case we exposed the hip joint in the usual manner and found that the head

of the bone had been absorbed completely in the seven months which had elapsed since the injury. We removed three fifths of the trochanter with the Gigli saw, leaving a piece about one fourth of an inch in thickness to which the muscles were attached. This fragment was then nailed to the neck of the bone, which had been freshened, so as to aid in the regeneration of a new head. The remainder of the trochanter was also nailed back in place with a wire nail. The leg was abducted and placed in a Traverso splint for eight weeks. Stitches removed. Primary union. Not allowed to use leg for four months.

September 30, 1912, the patient could extend, abduct, adduct and circumduct his leg. When seated he could cross it over the other leg by muscle action with the knee at right angles as so to put the hip in extreme abduction. He was able to bear his weight on the leg and could walk without crutches, but was advised not to do so for a while.

#### FRACTURE OF TIBIA AND FIBULA, NON-UNION

CASE 12 — H. P. W., a man aged 32, was admitted to Mercy Hospital December 27, 1911. Family history was negative. Patient had been a civil engineer in the Canal Zone. He had tropical dysentery in 1908, and malaria for past ten years.

Present trouble — June 9, 1911, was in railway wreck and his tibia and fibula were crushed, resulting in a compound comminuted fracture with division of anterior tibial artery. A purulent discharge started on the third day and continued for fifteen days when the external wound was entirely healed.



Fig 59 (Case 14) The tumor split open after its removal, showing how extensive the growth was, involving nearly all of the head of the bone except the articular surface and the outer portion of the epiphysis.

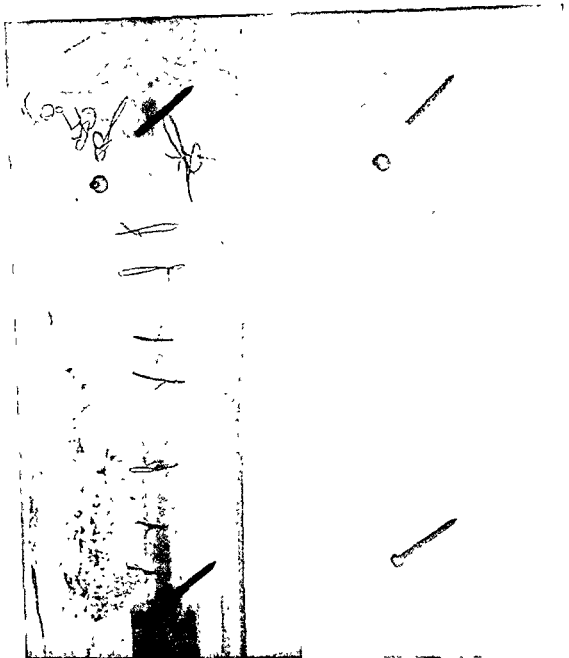


Fig 60 (Case 14) Skigram made two months after the operation, while patient was still wearing a plaster cast. Bone regeneration is already taking place as is evidenced by the shadow along the right hand side of the transplant. The nails above and below secure the fixation of the transplant and prevent its displacement. The phosphor bronze wire sutures were used to approximate the deeper layers of the wound. The small foreign body to the left and below the upper nail is not a part of the picture.

Fig 61 (Case 14) This skigram was made about a year after the operation and shows to what an extent bone regeneration has taken place. The transplant is no longer in evidence. The new bone is rapidly taking on the size and shape of the old bone.





Fig. 62 (Case 15). Fracture of the humerus about  $\frac{2}{3}$  inches above the elbow joint, with marked deformity and no effort at union, a typical pseudarthrosis.

Temperature ranged from  $100.6^{\circ}$  to  $102^{\circ}$  for first three days. Otherwise there was no constitutional disturbance. The leg was placed in a mold on the fifteenth day. Skiagram taken the next day showed an overriding of both bones with angulation of  $45^{\circ}$  degrees. No extension was put on. The mold was removed in four weeks. There was slight motion at the site of the fracture. Another mold was applied and left on for a month. The patient walked on crutches six weeks after the accident. When the second mold was removed the callus was a little more solid, but there was still some motion at the fracture. A plaster of Paris collar 12 inches wide was put on round the fracture and left on for three weeks. During this time he used crutches. The collar was removed. After two and one half months a second skiagram was taken (December 5) and showed an overriding of one and one half inches, with considerable mobility at the line of fracture. This mobility had increased slightly up to the time of admission.

**Examination** — This showed a non union of the tibia. Four skiagrams of this case showed how important it is to have the pictures taken from various angles. One showed an apparently excellent union, the second a fair union, the third almost failure of union, and the fourth a complete separation of the two fragments by an interposed cartila-

ginous or fibrous mass. The fibula was united. There was a slight external angulation at the site of fracture (Fig. 50).

**Operation** — An incision 4 inches long was made over the anterior surface of the tibia near its lateral margin. The line of fracture was exposed. A fibro-cartilaginous mass was deposited between the ends of the bones, there was no effort at bone reproduction. A groove one half inch wide and 3 inches long was chiseled through the anterior surface of the tibia down to the medulla, intercepting the fracture at its middle. The reamer was then used to free the medulla one half inch above and 1 inch below the groove. The tibia was then ready for the implant. A transplant  $4\frac{1}{2}$  inches by  $\frac{1}{2}$  by  $\frac{1}{2}$  by  $\frac{3}{8}$  was removed from the crest of the opposite tibia with the chisel in the regular way. It was driven into the lower fragment until the upper end of the transplant could be depressed into the groove in the upper fragment and admit of the insertion of the upper end into the medulla. It was then driven upward into the medulla beyond the end of the groove, so that the transplant locked. At the completion of this the leg felt strong enough to walk on it at that moment, so firmly did the transplant fix the end. The periosteum was then closed over the graft with catgut and the skin closed with horsehair. A plaster mold was applied extending from toe to 8 inches above the knee. Primary union resulted.

The mold was removed at the end of three weeks. The implant had healed in nicely. The mold was reapplied, and removed at the end of five weeks when the skiagram showed that a bony union had taken place. A leather mold was then substituted for the plaster mold and the patient was allowed to place some weight on the limb and walk with crutches. End result was perfect (Figs. 51 and 52).

#### UNUNITED FRACTURE OF TIBIA AND FIBULA

**CASE 13** — M. S., aged 22, was admitted to Mercy Hospital June 19, 1909. There was no record of family history or personal history.

**Present trouble** — August 26, 1908, a laundry stove exploded and a piece of iron struck the right leg midway between the knee and ankle on the anterior surface. The patient became weak and dizzy and perspired but did not vomit. He tried to walk but was unable to do so because "his leg bent" at the point of injury. He had no pain, only a numb feeling. He said that blood ran down his leg and that there were two holes on the inner side of his leg. Then he had sharp shooting pains. He was taken to a hospital and operated on the following morning, double wiring of both ends was done. He thought that some muscle was united and a piece of bone removed. His temperature rose to  $100^{\circ}$  F. He had pain in leg on motion only. The leg was put in a mold. Patient remained in hospital until Nov. 22, 1908. Six weeks after the accident a very successful skin grafting operation was done on the leg. Patient said that there was no infection at any time. He was in bed only fifteen days, and one month

before leaving hospital was walking on crutches. He had a circular cast on all the time, from time of admission to hospital until now. Cast was removed every two weeks and new one applied. He had pain in the leg for two or three days following the operation. In December wound reopened and patient went to bed. He was in bed twenty days, had no pain, but at night would get a numb sensation. He had hobbled around on crutches. Slight tenderness on pressure.

**Treatment** — Patient was operated on June 15, 1909. There was no callus production in tibia. Approximation was good. Effort at bone production made from the periosteum around the wire and outward. Ends of fibula had passed each other, the lower to the inner side of the upper. Edges were freshened of both tibial and fibular fragments, and approximation secured by the use of bronze wire. No union resulted (Fig. 53).

He was admitted to our service October 6, 1909. There was no ossification, slight callus production, apposition perfect. Bones were spread out, connective tissue removed from between them, and ends of bones freshened with chisel and all cartilaginous and fibrous tissue removed.

It was planned to make an intramedullary transplantation from the left tibia. The left tibia was exposed and two holes were bored through and nails inserted in these to steady the bone for sawing. A portion of bone was thus removed from the crest of the left tibia, measuring about  $\frac{1}{2}$  by  $\frac{3}{8}$  by  $\frac{3}{8}$  and about 3 inches long. The medullary cavity of both the upper and the lower fragment was reamed out and the transplant from the left tibia was driven into the lower end first, then the upper end was inserted and a nail placed into the implant transversely to keep it from being displaced on motion. The wound was closed with catgut. No drain. There was primary union in both the right and the left tibiae. Skiagrams were made repeatedly and showed the progress of ossification of the implant and of ossific union of the ends of the bone. An elongation of the tendo achillis had to be made on account of the contraction that had taken place in the gastrocnemius during the long illness (Figs. 54, 55 and 56).

**Result** — Perfect recovery, with full restoration of function.

#### SARCOMA OF TIBIA

**CASE 14** — N. M. a girl aged 14 was admitted to Mercy Hospital November 2, 1911. Family history was negative. Patient had the ordinary diseases of childhood, no rheumatism, no typhoid, no scarlet fever, no diphtheria. She had an attack of tonsilitis three years ago, good recovery, no complications.

**Present trouble** — About three years ago she fell from a porch railing, a distance of about 5 feet, and injured her right leg just below the knee, but paid no attention to it. About three or four months later she noticed a slight pain at the same point when running or jumping. The pain was just below the right knee joint. Some weeks later patient noticed that there was some swelling on the tibia



Fig. 63 (Case 15). This skiagram was made about six weeks after the operation. The transplant is still visible. Although the deformity was not entirely overcome, bone regeneration is progressing very rapidly.

just below the knee, but took no treatment and continued with her school work. About a year and a half ago, or eighteen months after the original injury, while playing she twisted her right leg. The pain following this was so severe that she was forced to lie down for several minutes before she got up and walked to the house. From this time on the pain became more severe and swelling increased in the region of the head of the tibia just below the right knee. One week after this injury a physician was called, who put the limb in a mold and instructed the patient to walk on crutches. She continued in this way for seven months, with very little complaint, except when she would put weight on her leg. About one year ago the mold was taken off and patient walked by aid of crutches and continued this

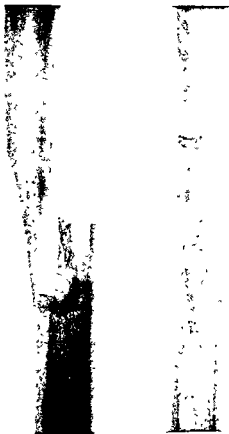


Fig 64 (Case 16) Fracture of the humerus in the upper third, with separation of a fragment

Fig 65 (Case 16) Skiagram taken about eight weeks after the operation, showing remarkably rapid regeneration of the bone. The transplant is visible, as also is the phosphor bronze wire suture which held the sequestrum in contact with the transplant

to the time of admission. She said that during the past year her leg had been considerably swollen just below the knee. It had tenderness to pressure at this point, and she had pain when she put her weight on the leg, but none at all when she was at rest in bed. During the entire course of the trouble she had never had chills, fever, nausea or vomiting. General health had been good.

**Examination** — This showed a marked elliptical enlargement of the upper one fifth of the tibia, most marked on the inner side. It was hard, encapsulated and free from attachment to the skin. It extended over three fifths of the antero-internal side of the shaft-head portion, was painful to pressure, did not fluctuate, and there was no bruit. Diagnosis chondrosarcoma of upper end of tibia. The joint was not implicated. There were no glandular enlarge-

ments, no metastases demonstrable. The patient was very anæmic (Figs 57 and 58).

**Operation** — Under ether anaesthesia incision was made on the inner side of the tuberosity of the tibia and extending down parallel to the tibial crest for a distance of 7 inches. A transverse incision was made inward across the tuberosity of the tibia to its posterior internal border. Elevating the skin flaps gave a good exposure of the tumor. It was clearly encapsulated and encroached closely on the epiphysis at its internal angle. All of its muscular attachments were freed, leaving the periosteum and the tendinous portion of the muscles attached to the tibia. The tendo patellæ was divided one fourth inch from its



Fig 66 (Case 17) Fracture of the upper part of the shaft of the humerus with Lane plate securing fixation of the fragments. There is splendid apposition and alignment, but no union.

tubercle attachment. The tibia was divided transversely with the saw,  $4\frac{1}{4}$  inches below the intercondyloid tubercle, and cut off above obliquely downward and outward, just below the cartilage, at the inner tuberosity, and ending three fourths inch below the cartilage at the external tuberosity and evulsed. The joint was open. The joint capsule was now sutured to the margin of the cartilage overlapping its under side, so as to close the joint. A piece of bone  $\frac{1}{2}$  by  $\frac{3}{4}$  by  $\frac{3}{8}$  inch and 5 inches long was removed from the crest of the opposite tibia. This was accomplished with the chisel, mallet and saw, and is not difficult if the retractor is properly fixed to keep the soft parts out of the field and steady the chisel when the initial creases are made. The lower end of the transplant was inserted for one half inch into the medulla of the tibia and a nail placed transversely in it to retard its further entrance. The upper end was placed in a depression one half inch deep in the remnant of the head of the external tuberosity of the tibia with another nail inserted transversely to retard its further depression. The internal hamstring tendons were attached to the side of the transplant by an encircling suture and the end of the tendo patellæ was fixed to the anterior surface of the transplant in a similar way. The wound was closed by a deep layer of catgut and the skin with horsehair. Primary healing. Leg placed in long mold from trochanter to toe (Fig. 59).

**Result.**—Patient was put to bed without extension. The leg was kept in a mold. Examination on November 28 showed complete primary union of the line of incision, with infiltration and apparent production of new callus around transplant, not the slightest evidence of inflammation. Leather mold applied December 25, 1911. Examination March 10, 1912, showed the upper end of the tibia normal in size. There were voluntary extension and flexion of 10 per cent. The patella was perfectly movable. She could bear some weight on the leg but was not permitted to walk on it.

A letter from her physician, Dr. Ben D. Baird, Galesburg, dated December 13, 1912, states that she has 70 degrees of motion and a fairly satisfactory joint (Figs. 60 and 61).

#### UNUNITED FRACTURE OF HUMERUS

**CASE 15.**—Male, G. S. aged 27, entered hospital because of an ununited fracture of shaft of right humerus.

February 5, 1908, he was riding in the caboose of a freight train when a rear-end collision occurred. The car in which he was riding was completely demolished. He was rendered unconscious and remained so for fully three days. He received many injuries, all of which healed without incident, except what he says was a compound fracture of the shaft of the right humerus. Two weeks after the accident his arm was taken from the wire splint in which it had been placed. The patient is not sure that the discharge had ceased, but knows that there was never much drainage. At this time the fragments



Fig. 67 (Case 17). Skiagram taken about six weeks after the implantation of a bone fragment. Regeneration had progressed to the degree that bony union was stated to have taken place.

were wired. Six weeks later the bone was still ununited. Wire was removed and he carried his arm in a cast. Three months after the accident he was operated on again. He thinks the callus was cut away and bone ends were united with catgut. This was four years ago, and a false point of motion still remains at lower third of the right humerus.

Examination disclosed a typical pseudarthrosis. On attempting to straighten the forearm by muscle action, the brachialis anticus and the flexors of the forearm pull the upper end of the lower fragment to right angles with the upper fragment. There is some fixation of the anterior elbow joint capsule. The skiagram shows a fracture of the humerus about two and a half inches above the elbow joint with marked deformity, the lower fragment being at right angles to the upper. There is no attempt at union. The ends of the fragments are fairly regular in outline and appear to be covered with slight amount of callus (Fig. 62).

**Treatment.**—Longitudinal incision on anterior surface of arm at outer margin of biceps muscles just outside the old scar of the former incision, which exposes the site of the fracture. A pseudocapsule had developed around the false joint. There was fibrous union of the fragments. The capsule was liberated from the fragments. The cartilaginous surface of the new joint was fairly well developed. All of this new formed tissue was removed and the ends of the fragments freshened so that live bone would be contacting. The fragments were readily brought into apposition. The medullary canals of both fragments were enlarged with the reamer to a sufficient size and depth to receive the transplant which was taken from the crest of the patient's tibia. The arm was now covered with a sterile towel.

The crest of the tibia was then exposed in the usual manner and a fragment of bone removed with saw and chisel measuring four inches in length by  $\frac{3}{8}$  by  $\frac{5}{8}$  of an inch, wide and thick.

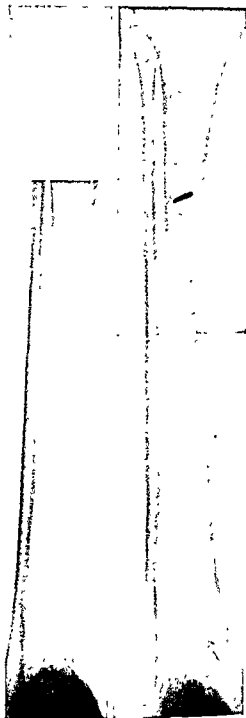
A small drill hole above and below marks the length of the implant. That guides the instrument in cutting the bone. The retractor guide guides the chisel in cutting out the piece of bone and also keeps the soft tissues away from the chisel, so that they will not be injured. This retractor guide has two short prongs, one on either end. These two prongs go into the drill-holes made in the tibia and hold all the tissues back out of the field. We saw the bone crosswise at the point where the drill-holes are because that is where the fracture will be made. We take out a V shaped piece of bone with a V-shaped carpenter's chisel all along the edge of the retractor and then the bone will fracture in that line. That deficiency in the tibia fills up readily. The implant is held with forceps and when removed is carefully placed in a piece of sterile gauze so that it will not be touched by hands or instruments and remain aseptic.

The incision in the leg is closed with deep catgut sutures, the muscle being sutured over the trough left in the tibia after the removal of the implant. The skin is sutured with horsehair. The wound is dusted with bismuth subiodide a desiccating powder, and sealed with gauze saturated with collodion.

One end of the implant is now driven into the upper humerus fragment for a distance of two and one half inches and the other end is slid into the lower fragment for a distance of about an inch by making traction on the arm and thus straightening

FIG. 68 (Case 18). Extensive destruction of the shaft of the tibia by osteomyelitis. Only a button of bone remains of the internal malleolus and about four inches of the upper extremity. The femur is in position and straight.

FIG. 69 (Case 18). Skigram taken about two months after the operation. The upper end of the transplant is fixed in the medullary canal of the tibia with a nail. The lower end is embedded in a depression made in the internal malleolus. Bone regeneration is taking place. The transplant is already of the size of the femur.



the lower fragment so that it will be in alignment with the upper fragment. The wound is now closed. The deeper structures are united with chromicized catgut. The skin is closed with horsehair, dusted with bismuth subiodide and the wound sealed with collodion gauze. No drain. A 5 per cent phenol gauze dressing is then applied. The arm was encased in a plaster of Paris cast including the shoulder clear up to the neck, the arm being flexed to right angles and the hand resting on the front of the body. The cast was cut with the Gigli saw.

Six weeks later the stitches were removed from arm and leg. Primary union. The cast was replaced and was worn two months more. When it was finally removed, firm union had taken place and the patient was encouraged to use his arm to a limited extent at first, gradually restoring it to full usefulness (Fig 63).

#### UNUNITED FRACTURE OF HUMERUS

CASE 16 — Miss E. J., aged 21, came to hospital because of an ununited fracture of humerus in its middle third.

One month previously she had fallen and fractured the humerus. The arm was at once placed in splints and a few days later a plaster cast was applied. When the cast was removed three weeks later, it was found that union had failed to take place. The upper fragment had pierced the biceps muscle and had become united to the overlying skin. Patient could not use her arm at all. The fracture was not compound.

Examination clearly showed non-union and the penetration of the biceps muscle by the upper fragment. It had become adherent to the skin. The skiagram showed that there was no effort at union. The ends of the fragments were clean cut. A sequestrum about an inch and a half in length was lying between the two large fragments of the shaft. There was no evidence of suppuration. The case was a favorable one for transplantation of an implant or bone splint from the patient's tibia. The cast was cut with a Gigli saw (Fig 64).

*Treatment* — Longitudinal incision along outer margin of biceps exposing site of fracture. The sequestrum was alive. The ends of the fragments were freshened and the medullary canal of each enlarged with the reamer.

A transplant measuring four inches in length by  $\frac{3}{8}$  by  $\frac{3}{8}$  of an inch was removed from the crest of the tibia in the usual manner and implanted into the upper fragment for a distance of an inch and a half and into the lower fragment for an inch. The sequestrum was utilized to serve as a lateral splint. The lower end of the upper fragment was encircled by a loop of phosphor bronze wire to secure immobilization of the transplant. Perfect alignment of all fragments was secured.

The wounds in the leg and arm were then closed with deep chromicized catgut and superficial horsehair sutures, dusted with bismuth subiodide and sealed with collodion gauze. A 5 per cent phenol

gauze dressing was then applied. The arm was immobilized in a plaster of Paris cast extending over the shoulder to the root of the neck. The arm was flexed at right angles, the hand resting on the front of the body. The stitches were removed in four weeks. Primary union. Cast replaced. After two months the cast was finally removed. Bony union with perfect use of the arm. The patient was advised to carry the arm in a sling for two months, exercising gently a little every day during that time. The skiagram showed that union between all the fragments had taken place and that the transplant was being gradually absorbed (Fig 65).

#### UNUNITED FRACTURE OF HUMERUS

CASE 17 — G. W. B., male, age 22, roundhouse man, came to hospital because of an ununited fracture of right humerus.

May 14, 1911 a turbine engine exploded and a piece of flying metal struck his right arm about four inches below the shoulder and another piece struck his elbow, cutting and bruising it, and fracturing the olecranon. The humerus was fractured. The wound in the elbow was sutured and healed by first intention. The fracture of the humerus was compound. An open operation was done and a four screw Lane plate applied. The wound was closed without drain, the arm dressed close to the side, flexed at the elbow but no cast applied. A sheet of heavy asbestos was used as a splint for the upper arm.

The stitches were removed after two weeks and then pus began to exude from the upper angle of the wound. This continued for about a month. The pus discharge ceased and the wound closed. Never had chills or fever. No bone fragments extruded from the wound.

There is now some limitation of motion at the elbow and non union of the humerus. The skiagram shows the Lane plate still in place and the fragments in splendid apposition and alignment, but there is non-union. This is an example of what always happens when a compound fracture is wired, nailed or a Lane plate is applied. Suppuration occurred (Fig 66).

*Treatment* — September 11, 1911, the fracture was exposed by a longitudinal incision. The third screw in the Lane plate was loose and there was considerable granulation tissue around the ends of the bone fragments. The remaining screws were fixed firmly and not suppurating. The plate was removed and the wound thoroughly curetted preparatory to doing the transplantation later when there would be no question about having a sterile field for inserting the transplant.

A second operation was done December 12, 1911. Longitudinal incision over outer aspect of arm, and excision of all scar tissue. The bone fragments are readily exposed. The ends are covered with fibrous cicatricial tissue, making a fibrous and preventing bony union. The bone is still porous where one of the screws in the Lane plate was inserted. The lower fragment overlaps the upper about three fourths of



Fig. 70 (Case 19) Healed fracture of the ulna, with subluxation of the lower articular end inward and downward over the carpus. The radius is also fractured and a considerable portion of the shaft is destroyed. The articular end of the bone is apparently in its normal relation with the carpus.

Fig. 71 (Case 19) Skiagram taken six weeks after the transplantation of a bone fragment into the radius. The ulna was shortened and the radius slightly lengthened. The phosphor bronze wire sutures are holding the ulnar fragments in apposition. The arm is now straight.

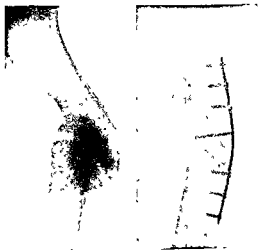
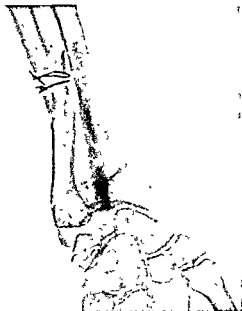


Fig. 72 (Case 20) Old ununited fracture of upper portion of shaft of femur, with angulation, an overproduction of callus on the ends of fragments, but no effort at union.

Fig. 73 (Case 20) Skiagram taken three months after the operation, showing Lane plate securely in position and the leg fairly straight, with bony union of the fragments.

an inch. We freshened the ends of both fragments removing all the fibrous tissue, and then enlarged the medullary canal in both fragments by means of the reamer so that the transplant, taken from patient's tibia, will be in contact with live bone everywhere.

The implant measuring four inches in length by  $\frac{1}{2} \times \frac{3}{8}$  was removed in the usual manner from the crest of the tibia with its periosteum and driven into the lower fragment for a distance of about  $2\frac{1}{4}$  inches, and then by means of traction on the lower arm it was slid into the cavity prepared for it in the upper fragment, for a distance of almost an inch. The humerus was in perfect alignment.

The deeper tissues in the wound, the muscle sheaths and fascia, are approximated with chromicized catgut and a few phosphor bronze wire sutures. The skin wound is closed with horsehair, dusted with bismuth subiodide and sealed with collodion gauze. A 5 per cent carbolic gauze dressing was next applied, and then a plaster of Paris cast extending downward from over the shoulder, the forearm being flexed at right angles with the hand on the chest. The cast was cut with the Gigh saw as usual. Stitches were removed after four weeks. Primary healing of wound, no suppuration. Union quite firm after 6 weeks and arm has grown steadily stronger. When last heard from had splendid use of arm (Fig. 67).



Fig 74 (Case 21) Osteitis fibrosa cystica involving the upper extremity of the humerus (Dr. Golden's case)

CASE 18 — Miss B., age 20, came to hospital on account of an old suppurative condition of the left tibia

October, 1908, she stepped off the porch and struck the inner side of her left ankle in the region of the internal malleolus on a cement block. She was conscious of the injury the moment it happened, but suffered no marked pain. She walked six or eight blocks before she noticed that her foot was swelling rapidly. She went into a doctor's office then and the foot and lower leg were swollen so badly that the doctor had to cut the shoe off. Immediately the leg became very painful and she felt nauseated. She says there was a bruised mark on malleolus. The doctor applied some antiphlogistin and a tight bandage. Then she could not bear her weight on the leg. She was taken home and put to bed, where she remained two days. On the third day she got up in a chair. She did not have any chill and does not know whether she had any temperature. The pain and swelling became less severe, and after



Fig 75 (Case 21) Skiagram taken about eight weeks after the operation showing rapid regeneration of bone along the transplant. The upper end of the transplant was sutured into the capsule the muscle attachments being secured by means of phosphor bronze wire sutures. Two wire nails fixed the transplant in the medullary canal of the humerus shaft.



Fig 76 (Case 21) Photograph of the upper end of the bone. The articular surface is not involved, although the interior of the head had been penetrated by the disease. The external shell of the bone has broken out, showing the cavities produced by the disease.





Fig 77 Case of fracture of the anatomic neck of the femur in a boy 14 years of age, seen seven weeks after the injury. The head is rotated and the ligamentum teres was strangulated, so that the head was dead, but fortunately aseptic so that it could be nailed to the upper end of the shaft for the purpose of aiding in the regeneration of a new head.



Fig 78 This skiagram was taken four years after the operation in Fig 77. The nails which were used to maintain the fixation of the fragments are still in place. The new head has been regenerated completely and bone growth has not been interfered with showing that the epiphysis was functioning. Perfect motion has been restored in the hip and it is impossible to detect the joint operated on when the patient is walking or exercising the hip.

remaining quiet for two weeks she got a pair of crutches and started to school. She had to keep the leg flexed under the seat. As soon as she allowed it to hang straight down it began to pain.

One week after starting to school (three weeks after injury) a circular plaster cast was applied extending from about six inches above the ankle to the toes. The cast was very tight, and soon the toes began to swell and tingle. Later they became numb and turned under. She was unable to straighten them. The cast was not removed for six weeks and when it was taken off she felt something snap about the ankle and the foot became suddenly inverted. She was unable to correct this. Two hours after the first cast was removed a second was put on with the foot in proper position. Toes were still flexed and numb. In six weeks this cast was taken off and two hours later the foot was again inverted. It did not turn in with a snap as before but turned gradually. In June 1900, she discarded one of her crutches and walked on the outer side of this foot. She was even able to put her entire weight on the leg.

She walked this way until November 1909 when she had a brace made to hold the foot flat and even then she could not put her weight on the foot. Had to use a cane or crutch. One morning in May 1910 she noticed that her cheeks were flushed. She did not feel well but went to school. She kept getting a little worse all the time and about the middle of the afternoon she went home. She sat on the edge

of the bed to remove her shoes and as she leaned forward she fainted and fell to the floor. As soon as she was helped to bed, she had a chill and the following day was very sick with a high temperature. The foot became very painful and red and soon began to swell again. At the end of a week or ten days the abscess which had formed opened just below the internal malleolus and discharged a thick pus. A few days later a piece of bone appeared in the opening in the skin and it was removed. This discharge continued for four or five weeks. Then the wound closed.

In July 1910 she again walked on the outer side of the foot and continued doing so until November. Then her ankle, knee and hip joints became painful and swollen. The knee and ankle were badly swollen but the hip was the most painful. This condition persisted for most of that winter and spring. June 12 1911 she had another chill followed by fever. She was in bed two weeks during which time she had excruciating attacks of pain in the back of the head and neck causing her neck to retract (opisthotonos position) and she would be unconscious for a short time (two minutes). She was taken to the hospital June 20, an opening was made over the middle of tibia and pus and necrotic bone were found. The shell of bone crumbled when the attempt was made to chisel it free and a large pocket of pus was found in the medullary cavity. This pocket was drained. After this operation she got a pain in the hip joint that was relieved with the

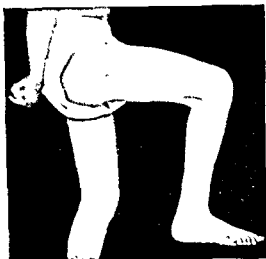


Fig 79 Showing the degree of voluntary flexion which the boy has four years after operation. Full motion has been restored to the joint.



Fig 80 When the boy is standing erect with both feet on the ground heels together both hips are on the same level apparently although the operated leg is about a half an inch shorter than its fellow.

use of Buck's extension. In August the ankle and knee became swollen and painful. The tibia near those joints was opened and drained. This relieved the pain and swelling. February 1912 most of the tibia from two or three inches below the upper epiphysis down to the lower was removed. A week later she got a severe crache and the following day went into a stupor which lasted three or four days. Suddenly a purulent discharge poured from her nose and she regained consciousness. Had a temperature of  $102^{\circ}\text{F}$  at that time. She remained in the hospital three months then went home with a plaster cast on her leg extending from six inches above the knee to the toes. This she wore until August 1912. Since then she has been wearing a heavy canvas cast. Has been walking with crutches since she left the hospital. She had one discharging sinus below the ankle that drained until about two weeks ago.

*Examination* showed absence of most of the tibia. About four inches of the upper end was intact. The end of the fragment was conical in shape. At the lower end there appeared to be only a very small piece of tibia remaining not more than three fourths of an inch in length. The lower epiphysis was gone. There was no discharging sinus but there was a wound about the size of a silver dollar just below the internal malleolus. The fibula was intact and in proper relation with the tibia above and the ankle below. The patient could not bear her weight on this leg (Fig 68).

*Treatment*—An incision about fourteen inches long was made over the tibia and exposed the tibial remnants above and below. There was no evidence of suppuration anywhere. The ends of the frag-

ments were freshened and prepared for the transplant by enlarging the medullary canal in the upper fragment with the reamer for a distance of an inch and a half. Owing to the small size of the lower fragment a cavity only one inch deep was made. The gap between the two fragments measured eight inches.

The crest of the opposite tibia was exposed in the usual manner and a piece of bone ten inches long by  $1\frac{1}{2}$  by  $\frac{3}{4}$  of an inch with its periosteum was carefully removed with chisel and saw and placed in the bed prepared for it in the other leg. The upper end of the transplant was driven into the upper tibial fragment for a distance of an inch and a half. The lower end was inserted in the cavity prepared for it in the small lower fragment. A small wire nail was driven through the upper fragment and the transplant so as to immobilize the latter. The muscle opponens was approximated with chromicized catgut and the skin wound was closed with horsehair dusted with bismuth subiodide, sealed with collodion gauze and dressed with 5 per cent carbolic gauze. A plaster of Paris cast was applied extending from the groin to the toes. The wound in the other tibia was closed in the same manner except for the cast. Four weeks later the stitches were removed from the leg, from which the transplant was removed. Primary union. Condition of patient splendid. The cast will not be removed from the operated leg for eight more weeks. This is the longest transplant we have ever used. The skiagram made one month after the operation shows that the transplant is in place and everything looks favorable for a successful outcome of the case (Fig 69).

## UNUNITED FRACTURE OF RADIUS WITH DEFORMITY OF WRIST

CASE 19 — Mrs E S., 54 years of age, came to hospital on account of disability and deformity following compound fracture of forearm.

December 21, 1911, while going downstairs, patient tripped and fell forward landing on a cement floor at the bottom. She does not know how she landed but on being helped to her feet she noticed that her wrist was bleeding and that she had lost control of her hand. She could neither flex nor extend it. She at once consulted a doctor who put on a temporary dressing and sent her to the hospital. He recommended operative intervention, which she refused. There was a comminuted compound fracture of the radius just above the epiphysis and a simple fracture of the ulna about two inches from its lower extremity. The wound was cleansed with an antiseptic and the fracture reduced. The arm was immobilized with a splint.

The following day the patient complained of chilly sensations and the temperature rose to 102° F. The arm became swollen and red, the axillary glands enlarged. On the fifth or sixth day, the wound at the wrist began to discharge pus, and a few days later, pieces of bone were discharged. This discharge persisted for about two months.

The patient was then anesthetized and an open operation done. The ends of the radial fragments were freshened and a Lane plate applied, although deep down in the wound there was still some infection present. A few days later the discharge reappeared. The plate did not seem to hold the fragments in apposition and in about four weeks it was removed. The wound then healed and the deformity now present soon manifested itself. The ulna is united in fair position but there is a radial shortening of about two inches. The tip of the ulna is dislocated downward and outward.

Examination disclosed a healed fracture of the ulna with subluxation of the head inward and downward so that it slid down over the carpus. The radius was fractured with destruction of the shaft causing a shortening of three fourths of an inch (Fig 70).

Treatment — The ulna was exposed at the seat of the old fracture by a longitudinal incision four inches in length on the external surface of the arm. The bone was divided with a Gigli saw and chisel on the plan of a tendoplasty when doing an elongation of a tendon. One half the circumference of the bone was removed for a distance of three fourths of an inch. The end of the upper fragment was beveled so as to permit of a literal approximation of the upper and lower fragments. This approximation was maintained by means of two phosphor bronze wire loops which encircled the ulna. This procedure shortened the forearm three fourths of an inch, compensating for the shortening of the radius.

The lower end of the radius was then exposed by a four inch longitudinal incision on the anterior

aspect of the arm. The old scar tissue was excised, as well as a mass of firm fibrous tissue which was interposed between the ends of the radial fragments. The fragments were then exposed freely and freshened. The medullary canal in both fragments was enlarged with the reamer and a 2½ inch transplant with its periosteum, removed from the crest of the patient's tibia in the usual manner, was inserted so as to secure continuity of bony tissue. The normal anatomy of the wrist was in large part restored by this plastic work on the ulna and radius. The bone transplant was not fixed with either nail, screw or wire.

The deeper layers of the wound were closed with plain catgut and the skin with horsehair. The wound was dusted with subiodide of bismuth powder and sealed with collodion gauze. A 5 percent carbolic gauze dressing was then applied and over this a plaster of Paris cast, extending from the finger-tips to the elbow, the wrist joint being midway between flexion and extension. The cast was cut with the Gigli saw as is our routine procedure.

Four weeks after the operation, all the stitches were removed. The wound had healed by primary union and the forearm was firm. Osseous union was progressing rapidly in spite of the patient's advanced age. There was absolutely no limitation of motion in the wrist or fingers. Pronation and supination were perfect (Fig 71).

## UNUNITED FRACTURE OF FEMUR

CASE 20 — C H D., male, age 38, came to hospital on account of non union of fracture of upper third of right femur (Fig 72).

December 9, 1910 he was thrown from a buggy a distance of about six feet landing on his feet first, then sat down. On attempting to rise he found that his right leg would not support his weight. He was carried to a store near by. The pain in the thigh was so severe that he was given morphin. He was taken home and within an hour from the time of accident he was anesthetized and the leg put in a plaster cast that extended from the foot to waist. Doctor told him he had a fracture of upper part of femur and another in the lower articular region of femur at knee joint. Four days after cast was put on, a Buck's extension was put on. The adhesives were put on the outside of the cast. Cast and extension remained on for six weeks. When the cast was removed, patient noticed that there was a deformity at site of upper fracture. The knee was swollen and painful and especially so when they attempted to move it. He remained in bed two weeks after cast was removed (eight weeks in all) and then began using crutches, which he is still using. His knee was sore for two or three months but then got entirely well. Flexion is somewhat limited. Extension is perfect. When standing erect, the leg at first was about 1½ inches shorter than the other. Thinks it has gotten some shorter since that time. Only a few weeks since he has tried to put weight on that side. The thigh is very weak and has a

little pain. Never had any temperature that he knows about.

**Examination**—There was a marked outward bowing of the right femur at its upper third with failure of union. Was unable to bear any weight on leg. Skiagram showed simple fracture with ends of fragment covered by considerable callus formation, but no effort at union. The fragments were displaced outward to form an angle of 45 degrees.

**Treatment**.—A longitudinal incision on outer aspect of femur extending down to vastus externus muscle separated and fragments readily exposed. The fragments were freed with scalpel and chisel. There was a typical pseudankylosis. The end of each fragment was sawed off, removing all callus, so as to permit of good approximation. A fragment of bone, measuring  $2\frac{1}{2}$  inches long and  $\frac{1}{2}$  inch wide and thick was sawn off of one of the pieces removed from the end of one of the fragments and was inserted into the cavities which had previously been made with the reamer in each fragment. A nail was then driven through the transplant between the ends of the fragments to prevent its slipping up or down.

A six screw vanadium steel Lane bone plate was then applied to the femur on its external surface. Thus approximation of the fragments was secured and the transplant will allow bony union to take place (Fig 73).

The wound was then closed with phosphor bronze wire sutures approximating the aponeurosis, deep plain catgut sutures and horsehair skin sutures. The wound was dusted with bismuth subiodide, sealed with collodion gauze and dressed with 5 per cent phenol gauze. A plaster of Paris cast was then applied, extending from the waist to the toes.

**CASE 21**—R. C., 13 years old, entered Mercy Hospital because of lameness and tenderness of right upper arm. His family history is negative. He was always free from digestive disorders of all kinds, never had rickets, scarlet fever, rheumatism, tonsillitis, or sore throat. He always was a strong, active boy, with full use of both arms, and both arms and shoulders were of the same conformation.

Early in 1911 while throwing a ball very hard, he experienced a sudden pain in the right arm four inches below the shoulder. On attempting to raise the arm he found that he could not do so, it hung limply by his side. A doctor told him that it was broken, and placed the arm in a splint for six weeks. Union was apparently perfect, and he gradually regained full use of the arm.

In March, 1911, he fell on a stairway, striking on his right arm and breaking it. He carried the arm in a splint for six weeks, and again it became perfectly useful, but for four or five days only. He fell to the floor, striking on his left shoulder, but the right arm broke (third fracture). There was little pain connected with the injury. The arm became useful again, though it remained a little lame.

In July, 1911, he attempted to sit down on the floor and felt his arm and hand were limp. He had no pain. The arm was not fractured, but on examination he noticed for the first time that the arm was larger at point of fracture and uneven. All the fractures had occurred at the same point. Arm again became useful. Four weeks ago arm was lame and he could not raise it from body, and a tenderness has been present at site of fracture since that time. Wassermann negative. Leucocytes, 8200. Hemoglobin, 80 per cent. Urine alkaline, but otherwise normal.

**Examination**—Considerable tenderness over upper end of humerus, inability to raise arm, some enlargement and increased resistance on palpation. Skiagram shows fusiform enlargement of upper end of humerus, not involving the articular surface of the head of the bone. It was a typical case of osteitis fibrosa cystica (Fig 74).

**Treatment**—Operation by Dr. John F. Golden. Incision was made directly over point of right shoulder on its outer and slightly on its anterior aspect. This divided the deltoid longitudinally and passed down to the bone, the shaft of the humerus, for fully six inches. At the upper angle of the incision the capsule of the joint was exposed, and at the lower angle could be seen the musculospiral nerve. This nerve was tested with the excitator both before and at the completion of the operation and found to be uninjured.

At a point  $5\frac{3}{4}$  inches below the head of humerus the shaft showed absolutely no signs of involvement. Here the bone was freed of all its attachments, retracting the musculospiral nerve. A chain-saw was placed about the humerus at this point and the bone was divided.

The capsule of the joint was now divided circularly at its attachment to the neck of the humerus. The muscular attachments about the head were freed, keeping very close to the bone and even removing a small amount of it at the greater and lesser tuberosities. The outer head of the biceps was lifted from its place in the bicipital groove and displaced inward. It was not cut.

Now the upper end of the humerus was plainly visible. This portion was fully  $5\frac{3}{4}$  inches in length and triangular in form, with broad end at upper end of bone. The largest diameter was  $2\frac{1}{2}$  inches. The mass was globular, expansible, and cystic, with eggshell-like portions of bone in places, and brittle. In other places it was more fibrous and less fragile. The periosteum had previously been removed when the muscles were taken off. Periosteum was carefully examined and found to be free from involvement in the process. Beginning at the inner side, the periosteum was elevated and the mass rolled outward and upward, detaching the periosteum from it until it was completely freed. Great care was used lest the musculospiral nerve be endangered in this process. The head of the humerus was not involved in the process, and the articular surface was apparently perfectly normal (Fig 76).

In considering the operation, the first question that presents itself is, in what class of cases should we advise the operation. Undoubtedly the first are cases of dacryocystitis with repeated abscesses. In these cases the cicatricial obliteration of the canal is so great that other methods of treatment are impossible. The next are cases in which, although the lachrymal abscess has not been repeated there is a lachrymal fistula through which tears drain away with resulting occlusion of the lachrymal drainage canal, and there is a third condition, in which although the catastrophe of lachrymal abscess has not yet supervened and although the fluid can be forced through the canal into the nares if the lachrymal syringe is used with considerable force, the retention in the sac is so obstinate that the sac either cannot be emptied at all with digital compression or only occasionally. The fact that a low grade of infection may remain if the condition persists, and that the infection may be regurgitated into the conjunctival sac makes these cases a menace to the eye itself and this is particularly true when operations are done which require the opening of the globe of the eye more especially in operations for cataract. A very considerable portion of all cases of infection of the corneal wound in cataract operations is due to an unsuspected source of infection in the lachrymal drainage apparatus, and when it is known that such an infection exists the radical operation for the extirpation of the sac is the height of conservatism.

In public clinics where the long continued attendance of the patient is difficult to obtain, treatment is almost always omitted before the case is completed. Many patients who are unwilling, either on account of their work or the distance of the clinic from their homes, to give the necessary time for treatment, are willing to submit to an operation which only demands attendance for a week or two. There are also occupations, such as those of the stone mason, the machinist, and others, in which repeated injuries of the epithelium of the cornea are likely to afford opportunities for the entrance of micro-organisms. When the patient in such cases is unwilling to sub-

mit to treatment for any considerable length of time, he should be advised to have the sac extirpated.

Major Elliot of the East Indian Medical Service has urged that in cases of septic ulcer of the cornea due to infection from the lachrymal sac, immediate excision of the sac has a favorable influence upon the corneal condition, and insists that in such cases the sac be removed. There are certain other conditions of the lachrymal sac, such as those cases in which a persistent trachoma is maintained by the trachomatous condition continuing its course in the lachrymal sac, where operation for extirpation is entirely justified.

The principal difficulty of the operation is due to the fact that, after the long continued inflammatory process, the tissues have become so changed in their macroscopic appearance that the walls of the sac are not easily differentiated from the surrounding tissues, with the result that fragments of the pus-producing mucous membrane are left behind and are a source of new pockets of pus in the same locality. In order to obviate this difficulty a number of expedients have been devised all having the purpose of distending the sac in such a manner that its outline can be easily recognized. Holmes suggested the injection by means of the lachrymal syringe, through the slit canaliculi, of a thick starch in warm solution which had been colored with iodine, and that the entrance to the sac be then closed with hæmo-static forceps. Such a method, to be efficient requires, of course, that the outlet into the nose should be closed. Others, such as Meller have suggested in a similar manner the injection of melted paraffin having a melting point of  $110^{\circ}$  to  $120^{\circ}$ , and then the application of cold compresses to harden the mass. One of the objections to this method is that if there happens to be unsuspected openings through the walls of the sac into the neighboring tissues, the warm paraffin is poured out into these tissues and remains permanently. As it is practically non absorbable, accidents of this sort are annoying.

Others have suggested that paraffin of much higher melting point should be used

and injected cold by means of a powerful syringe, thus forcing in a stream of small cylindrical fragments. Steel is credited by Weeks with a suggestion to pack the sac with sterile cotton wool, either through the slit canaliculi, or through an opening made into the sac for that purpose. Ohlstrom and others have constructed and introduced instruments into the sac with the object of defining its outline during the operation. The tendency of the day, however, appears to be to discard all these methods and trust to intelligent, methodical, anatomical dissection for guidance in outlining the sac.

Most operators in this country operate under a general anaesthesia, but in Europe there is an increasing number of men who operate under local infiltration anaesthesia, using for the purpose a mixture of cocaine and adrenalin, hoping thereby not only to get sufficient anaesthesia to enable them to operate, but also to control the very annoying hæmorrhage which so often accompanies this operation. Meller, who strongly advocates this method, uses a solution which contains 8 to 9 parts of a 1 per cent solution of muriate of cocaine and 1 to 2 parts of 1-1000 solution of adrenalin chlor. One cc of this is injected subcutaneously by means of Pravatz' syringe in several punctures. The first is 1.5 mm below and slightly to the temporal side of the inner canthus. At this point a few drops of the solution are injected, then the syringe is pushed in a few mm farther toward the sac, keeping just beneath the skin, a drop or two more injected, and this continued until the needle has passed over and beyond the internal canthal ligament. The second puncture is placed between the upper part of the lachrymal sac and the cupola of the sac on the median side just above the inner canthal ligament, and a few drops of the solution injected, and by a third puncture this process is repeated just below the canthal ligament. The area is then gently massaged. In elderly patients with advanced arteriosclerosis not more than 1 should be injected, and this is generally sufficient in these cases.

The usual antiseptic precautions should precede operation, of special procedures one of the best is,

perhaps, putting ointment of bichloride of mercury into the conjunctival sac and smearing it over the lids and the region to be operated on the night before operation, and covering the eye with a pad and bandage. Holmes recommends that before operation a strip of gauze should be packed up under the inferior turbinate over the exit of the canal, to prevent blood from entering the pharynx. If the conjunctival sac contains purulent material, it should be emptied by pressure, the pus caught and removed on antiseptic swabs, and the face again washed with an antiseptic. Following this it is wise to again flush the sac with an antiseptic solution.

The first step in the incision should be the definition of the internal palpebral ligament by drawing the lids outward, and then defining the line of incision by following with the finger from the lower border of the orbit the ridge extending along the outer edge of the lachrymal groove up to the ligament. The incision begins just below the ligament and is continued crescentically first downward and then outward, following the crest of the ridge. The incision should be from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  cm in length. Elliott states that the average incision in 310 cases was 20 mm, the maximum being 27 mm. The incision should be made boldly down through the subcutaneous tissue to the anterior lip of the lachrymal groove, avoiding if possible the twig of the facial artery from which an annoying hæmorrhage may result. In making the incision the point of the knife should be directed somewhat obliquely toward the median line. Meller's or Axenfeld's retractor should then be inserted. The next step is an incision through the aponeurosis, which should be carefully done to avoid cutting the walls of the sac that lie directly beneath. This is safest perhaps, when done upon a director. This incision should follow very closely the bony outline.

Many operators do not feel that it is necessary to avoid the palpebral ligament, and the operation is much more difficult when this structure is left uncut. If the operator decides to sever the ligament, at the conclusion of the operation one or two stitches must be carefully placed to unite the cut edges. When this is done in a majority of cases no harm results from this method of operative procedure. The incision completed, the sac is lifted up from its bed in the lachrymal groove by blunt dissection commencing on the nasal side and following the bony wall closely. When well loosened, it can be held forward with a large strabismus hook, and the dissection then proceeds upward until the apex of the sac is reached. It is usually necessary to cut along the outer edge of the lachrymal groove with scissors or a bistoury. This dissection should be made very close to the walls of the sac, to avoid danger of making an opening into the orbital cavity, which may be dangerous at times from a resulting orbital abscess. When this has been carefully done the bulk of the sac is lifted up throughout its entire portion, the apex of the sac seized with forceps and dragged

It was a question whether or not to remove this head. It finally was decided to remove it.

A transplant seven inches in length was now removed from the right tibia and ends rounded into shape. A hole was drilled in each end of this strip, the lower hole being about  $1\frac{1}{4}$  inches from the end. A hole was also drilled in the medulla of the shaft of the humerus, and the transplant inserted into this hole a distance of  $1\frac{1}{2}$  inches. A nail was placed transversely through transplant and humerus, thus preventing the transplant becoming further embedded in the medullary canal. Using a catgut suture as a purse-string, the capsule of joint was puckered in about the upper end of the transplant, which rested in the glenoid cavity. Now two wire sutures were passed through a hole in the upper end of the transplant and also through the joint capsule.

Muscular attachments were not included in this. The wires were tied about the capsule only as an additional means of keeping the transplant in position in the glenoid fossa. The old periosteum of the humerus was sutured around the transplant. This carried the muscular attachments, none of which had been separated from it. A row of sutures closed the incisions in the fascia and aponeurosis, another of horsehair closed the skin incision. A plaster cast was applied, covering the arm from the side of the neck to the wrist, with arm at right angles (Fig. 75).

*Result*—Six months after operation: Patient made perfect recovery and has now full function of arm and a movable shoulder joint. The improvement is very satisfactory. The regeneration of the upper end of the humerus is progressing well, proceeding upward from the shaft of the bone.

## EXTIRPATION OF THE LACHRYMAL SAC<sup>1</sup>

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THE treatment of disturbances of the lachrymal drainage apparatus by the mechanical reopening of the canal has been pursued for many generations, and it is not long since this method was all but universal. I remember well when the surgeon at the Massachusetts Charitable Eye and Ear Infirmary, on entering the clinic, would pick up his apron and laconically remark "Probes first, please," and then there would be marshaled ten or twelve cases, who would soon be seated on a back row of seats with silver horns of assorted sizes projecting above their eyebrows.

The treatment by probes gave many disappointments, and there were many difficulties attending it, the first being due to the fact that patients were unable or unwilling to give the long amount of time required for the dilatation of the canal, and second, the mechanical dangers of the procedure itself, for false passages were far from unknown; therefore, this line of treatment in many cases failed when most skillfully and conscientiously pursued. The alternative to this method was practically continuous probing

by the introduction of styles, and this naturally led to the use of hollow styles or cannulae to make a semi-permanent lining of the opening produced by the probes. These latter methods failed and were abandoned largely on account of the difficulty in maintaining cleanly conditions, and accidents which resulted from the enlargement of the passage and the falling of the cannula through into the nasal cavity, from which it was extracted only with considerable difficulty.

The need of better methods led to minor changes in the procedure, the first being the introduction of much larger probes, such as those of Theobald, which not infrequently created an opening sufficiently large to remain permanently patent. Suggestions have also been made of an artificial opening from the lachrymal sac directly into the nasal cavity. This procedure, however, has never obtained any great popularity.

The annoyances and lack of success of these various methods convinced the ophthalmological profession that there was need of more radical methods of procedure, and this found its expression in proposals to extirpate

the lachrymal sac. While this method has grown in popularity but slowly in English speaking countries, in continental Europe it has been accepted with considerable enthusiasm, and there are certain clinics, I am told, where practically all cases of epiphora are operated upon in this manner.

The clinical history of the disturbance of the sac and lachrymal canal is somewhat as follows. It is first noticed by the patient that the tears overflow easily from any irritation, such as that caused by a cold breeze, smoke, or any emotional disturbance of a slight character. This, of course, is due to the fact that the narrowing of the lachrymal duct through the catarrhal condition makes it insufficient to care for more than the normal flow of tears. As this condition proceeds, the epiphora becomes more constant and the tears filter through from the sac only slowly and with difficulty, then mucus and epithelial detritus from the conjunctival surfaces are retained in the sac as the water filters through, the sac becomes distended, and is filled with this material. This naturally forms an ideal culture medium, and there are washed down from the conjunctiva pyrogenic organisms which become implanted upon this material; these multiply rapidly, and then comes the condition spoken of as dacryocystitis, or lachrymal abscess, the swelling and pain from which are very considerable; and eventually the abscess, if allowed to follow its own course, points upon the surface near the lower inner margin of the orbit, empties itself, closes, and upon favorable conditions again arising, repeats itself. Eventually *fistulae* may be established, discharging a mucopurulent material, and the adjoining tissues become involved, extending even to the bony walls themselves.

Now to the conservative surgeon it is evident that, because this pathological procession of events has started, it is not absolutely necessary that it should continue to the last stage as described. Indeed, in the early stages of this process, unless the exciting cause is actual bony deformity at the nasal end of the canal, a vast majority of cases can be cured without any operative procedure whatever. It is necessary only to treat the lining membrane of the drainage

apparatus with antiseptics persistently and consistently over a period of months, and even years, to effect a practical cure. The best applications are those which are active in inhibiting the growth of such micro-organisms as are usually found in the conjunctival sac. The two which are most naturally suggested are sulphate of zinc and bichloride of mercury.

Many others are of value under various modifications of the condition and are easily suggested to the mind of the competent ophthalmologist. But in order that they should be of value, it is necessary that they should reach the mucous surfaces of the sac and canal. This is often attempted by the surgeon's dilating the canaliculus and injecting the necessary solution with the lachrymal syringe. This is a method highly efficient, but it cannot be repeated sufficiently frequently by the surgeon to derive all the benefit which is possible from the applications. Therefore, the patient himself must make the applications by putting drops into the conjunctival sac, and making sure that the lachrymal sac is first emptied. This is most easily accomplished by teaching the patient how to compress the sac and force the contents into the nose, and not back into the conjunctival sac. If this is done just preceding the dropping of the collyrium into the eye, and the canaliculi and puncta are still efficient, the fluid is immediately pumped into the drainage apparatus, and a very efficient application is made by this method, and if an occasional gentle, not too wide dilatation of any narrowed passage of the canaliculi or canal is made under antiseptic precautions, most such cases recover. But when this much to be desired result is not obtained, and it is evident that something more radical should be done, the trend of the opinion of today is that the sac should be extirpated. That the extirpation of the sac means a radical cure has long been known, and many attempts have been made to destroy the sac with caustics and cauterization with occasional success, but there have been many disappointments due to the difficulty of making successful applications of these agents in the upper portion of the sac.



down, and the canaliculi cut; then the sac, being freed, is dragged upward as far as may be, and cut off below as deeply in the bony canal as possible. The lachrymal fossa is then carefully searched, and if any portions of the sac, granulating tissue, etc., remain, they are removed. Holmes advises splitting the canaliculi their entire length. If there are fistulae they must be completely excised. Elliot recommends that at this stage of the procedure the sac should be split open and examined under water to make sure no part is left behind.

When the ligament has been left, it is often difficult to remove the tip of the sac, which is placed somewhat deeply behind it. In such cases, it has been recommended that a ball shaped cautery should be used to destroy that portion of the sac which might possibly be left.

When the preceding inflammation is of long standing, and the fistulae have matted all the tissues together, it is often difficult or impossible to recognize the sac. In such cases one should cut down on the anterior crest of the lachrymal groove, separate up the tissues on that side, and with hook or elevator seize the tissues and excise the sac with its surrounding walls without too much attempt to make out anatomical details. Keep always as close as possible to the lachrymal groove. In the ordinary case, after hemorrhage has been stopped, if the wound does not look clean, remnants of the sac probably remain. If at this stage of the operation it is determined that there is marked necrosis of the nasal bone, possibly the best expedient is to remove all diseased bone, making an opening into the nose in the region of the middle meatus.

After the sac has been removed, cocaine should be dropped into the wound and introduced into the canal. We should then pass large probes, from No 9 to No 12 Theobald, and the walls of the canal should be thoroughly curetted. This is generally sufficient to produce good drainage, but Elliot recommends, in some cases at least, that a red hot spindle-shaped cautery should be thrust boldly down the duct to insure the destruction of its lining membrane. After all bleeding has ceased, the wound should be closed with a subcutaneous horsehair suture, in which case, if suppuration does not result, and this is not to be expected if the integument is not infected, the resulting scar is insignificant and the cosmetic appearance is much superior to that attained by cauterization of the sac or by its excision by natural processes, in which case the scar is down onto the bony structure beneath, forming a distinct and unsightly depression.

If the preceding inflammation has seriously involved the cutaneous structures, union by first intention is much less likely, and in such cases it is better to pack the sac with gauze for a few days and allow the wound to heal up from the bottom. The number of days required is a result of this opera-

tion has not been great. Occasionally the pressure made on the cornea results in some damage, and the rupture of acute ulcers of the cornea from the same cause are not unknown. Veazie has reported a case in which the sac and gland were removed after repeated attacks of dacryocystitis, in which an anomalous paralytic neurokeratitis developed.

The resulting effect upon the epiphora is the most interesting topic in this discussion, for epiphora is one of the most disagreeable symptoms to the patient, and often perhaps the symptom which makes him consent to operation. The flowing of tears previous to operation, rendered more profuse by refractive strain, mental and physical distress, and local irritation of the conjunctival sac, such as wind, cold, etc., appears to be increased still more by an irritation proceeding from the inflamed sac. Lancaster states that experiments on guinea pigs show that extirpation of normal sacs is followed by diminution, not only of the activity but also of the size of the lachrymal gland—a compensatory atrophy—and it is highly possible that a chronic irritation of the sac also increases the activity of the gland. If this is so, it would account for the undoubted fact that extirpation of the lachrymal sac does diminish this annoying symptom, although it is seldom the fact that local irritation of the conjunctival sac by cold winds, etc., does not produce a temporary epiphora after the operation.

In 310 cases reported by Elliot in India, there were but 53 cases which were followed up for three months, as to the effect upon the epiphora. Of these, nine failed to have the epiphora relieved. In such cases, it is generally considered necessary to remove the whole, or a large portion of the tear gland. I have asked a number of operators who pursue this method frequently, and have been told that they have seldom found it necessary to do this additional operation. Personally I have never done an excision of the tear gland, and I prefer to leave the discussion of that portion of the subject to some gentleman of larger experience.

Several years ago, when I first began to extirpate tear sacs for this condition, I

operated on six cases by extirpation of the tear sac on one side, and by opening into the sac on the other side and making a large opening through into the nose by means of the largest sizes of Theobald's probes at the first sitting. This opening, which did not profess to be anything but a method of making a drainage opening through the bone, healed with a permanent drainage canal, although it was not found necessary to pass large probes more than three or four times, these occasions being included within ten days or two weeks. Three of these cases I have been able to follow since, and all three

have stated to me repeatedly that there was more epiphora on the side in which the extirpation of the sac was performed than upon the other. Therefore, it is evident that the result of the operation is not as perfect from the point of view of function as it is from that of protecting the eye from infections proceeding from the lachrymal apparatus, nevertheless, the operation is steadily growing in favor, and properly so. While not ideal, it does give us a practical method of stopping an annoying and dangerous series of events in a class who cannot be treated successfully by any other method.

## A CONSIDERATION OF FINAL RESULTS IN HYPOPHYSEAL SURGERY<sup>1</sup>

WITH REPORT OF A CASE

By ALLEN B. KANAVEL, M. D., CHICAGO

WHILE the final word has not by any means been said as to the technique involved in the surgical treatment of diseases of the hypophysis, the general line of procedure at least has been determined, and we have progressed far enough to demonstrate the propriety and feasibility of surgical intervention in certain cases.

A sufficient number of patients have now been subjected to operation for us to begin to consider carefully the results of these operations, not alone as to life, but as to the alleviation of the symptoms and the influence upon the course of the disease after the lapse of a considerable period, to the end that we may know what may be expected as a final result, and may not rush our patients into ill-advised operations before the possibilities are known. Because a patient survives an operation is no proof that the operation was successful. The following case is, therefore, reported.

*Typical Frölich type of hypophyseal disease, suffering with marked signs of intracranial pressure. Operated upon two years ago, infranasal route, cyst evacuated; recovery, result of feeding pituitary gland over two years.*

Stanley W., aged 18, white male, native of United States. Admitted to Wesley Hospital

February 20, 1911, under diagnosis of hypophyseal disease made by Dr. Hugh T. Patrick. *Complaint* Severe frontal and temporal headache. *Impaired vision* patient could not recognize objects, only light and darkness. *Photophobia* Persistent vomiting. *Family history* No history of tuberculosis or malignancy. *Habits* Appetite fair, bowels regular. *Previous illness* Measles, whooping-cough and chicken-pox in childhood, typhoid at eight, being sick about three months. Suffered with enuresis till he was 16. Has been weakly ever since he had typhoid.

*Present illness* The present trouble dates from his 14th year. Though mentally bright and well developed he lacked physical development and vigor. His appearance was anemic. His voice did not show the normal change which takes place about puberty, and he remained sexually undeveloped. He began to have frequent attacks of sick headaches, with which he had considerable gastric distress, nausea, and vomiting. During his 15th year he began to notice that his eyesight was failing and obtained considerable relief by using glasses, but on account of more or less photophobia he wore smoked glasses part of the time. Under these conditions he continued his work as clerk in comparative comfort until about a month ago, when his eyes suddenly failed him. He had aching pains in the eyeballs. At times his pupils would dilate markedly, especially when the pain was bad. Photophobia and impaired vision became more marked. With this he developed an acute and spasmodic frontal and temporal headache. The pains were sharp and shooting and frequently

<sup>1</sup> Read before the Western Surgical Association, Cincinnati, Ohio, December 21, 1913.

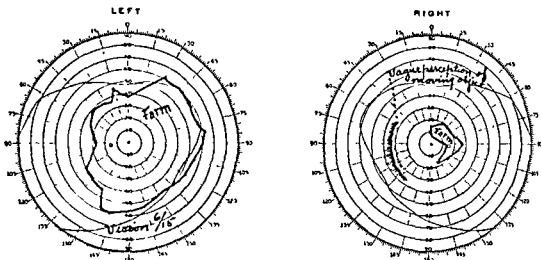


Fig. 1. Five findings (Dr Westcott) February 3, 1911. Eighteen days before operation.

radiated into the occipital region. On February 18 he had his first attack of vomiting which he attributes to the onset of a paroxysm of headache. These attacks became more severe so that for three days he has had continued headache and vomiting and has eaten nothing.

**Examination.** General appearance, that of a boy of 12 years, slightly anemic, full growth of nails, and hair on head, general conformation, adiposity above the average but not excessive due possibly to prolonged vomiting, action marked in urine, no excessive development of breasts, no growth of hair on body or pubic region, except fine hairs invisible to ordinary inspection, back normal, ears normal, teeth normal<sup>1</sup>, nose normal, right eye slightly divergent, pupils slightly large and they have been so while patient has been in hospital subsequent to the operation. Patient states that they are always so during his attacks of pain but that they may be smaller between attacks. The testicles are both present but they and the penis are very small.

	Examination Hospital Feb 20 12	Examination Oct 27 11
Circumference of head glabella to occiput	57 cm	61 cm
Angle of jaw closed to bregma	60 cm	
Circumference of chest exp 73 in	67 1/2 cm	exp 67 in 74
Circumference around umbilicus	71	81
Circumference of humerus at mid file	18	19
Circumference of forearm at mid file	15 1/2	16
Length arm acromion to tip of middle finger	65	65
Length elbow to tip of middle finger	30	30
Circumference thigh at mid file	35	40
Circumference hip through trochanter	70	73 1/2
Circumference leg at mid file	26	27
Length of leg ant tip spine to ant malleolus	79 cm	78 1/2

<sup>1</sup> Dr Goetz of Naperville says that he had a third development of teeth 4 or 5 of the second group being cast off at about 12 and a third group appearing.

The examination of the thyroid, lungs, heart, and abdomen negative. Height 145 cm (Patient says his height was 4 ft 9 in (141 cm) a year ago).

**Operation.** February 21, 1911, by Dr Kanavel, assisted by Dr Woller, F. Gordon Wilson, B. C. Cushway and H. M. Richter. Patient had been given urotropin at home for one week previous to entering hospital. Just before being anesthetized the patient's nose was packed with strips of gauze saturated with 5 per cent cocaine, and as soon as the patient was anesthetized these were removed and the nose packed with adrenalin gauze full strength. The anesthetic (ether) was now changed from oral to rectal and this was given throughout the operation under the supervision of Dr J. F. Churchill, with complete satisfaction.

An incision was made close under the nose and on the nasal crease at the side, and the technique carried out exactly as described in previous contributions.<sup>2</sup> The middle and inferior turbinates were removed. There was some difficulty in locating the sphenoidal ostia so that it was necessary to chisel through bone directly. No evidence of a sphenoidal cell was found at any time. The dura was exposed and a bulging pearl mass about 3/4 inch in diameter was exposed. There was no marked pulsation until partial evacuation of the cyst had been made. An attempt was made to aspirate the tumor since a diagnosis of a cyst had been made by Dr Kanavel. The aspirator did not work, however so that it was concluded that the diagnosis of a cyst was incorrect and with a scalpel an incision was made the length of the exposure through the dura. Immediately the underlying tissue bulged through and a chocolate colored fluid escaped, fully

<sup>2</sup> J. Am. M. Ass. Nov. 20, 1909 and Surgery, Gynecology and Obstetrics April 1910.

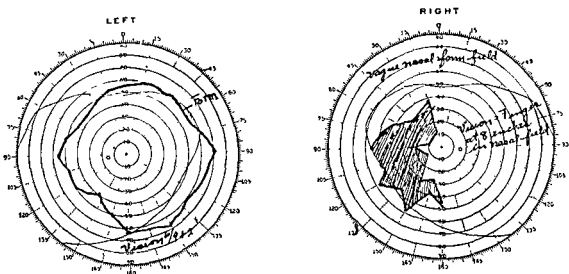


Fig. 2. Lye findings (Dr. Westcott) October 15, 1912. Twenty months after operation.

an ounce ran out of which about one half ounce was saved and given to Dr. S. A. Mathews for examination who reported that the fluid contained a pressor substance. He injected it into a dog and obtained an increase of 20 mm. pressure of mercury which persisted for half an hour. Dr. Mathews draws attention to the fact that cystic fluids generally cause a fall in blood pressure.

The cyst was curetted thoroughly and the contents given to Dr. Zeit for examination. This consisted of a granular detritus. An attempt was made to secure the cyst wall but it was unavailing.

A strip of iodoform gauze was inserted into the cyst and the end brought out through the nose. The nose was packed with strips of gauze, the posterior nasal plug, which had been inserted before the operation and which had effectually prevented the blood from entering the wound, was left in.

The nose was sutured in position the septum being brought to the median line and held in place by the ends of the packing strips which were brought out through the nose (Fig. 3).

The patient left the table in good condition.

Subsequently he was given olive oil by rectum to allay the irritation of the ether. Normal salt was given subcutaneously as a stimulant and to help remove the ether from the system.

**Subsequent history.** The first strips of gauze were removed at the end of 16 hours, more at the end of 48 hours and the final strip leading into the cyst was removed in 56 hours with the posterior nasal plug.

Following the operation the patient complained of headache and vomited rather constantly for 48 hours when the vomiting ceased completely. The cause of the vomiting may have been either a retention in the cyst or post-anesthetic vomiting. I am rather inclined to look upon the former as the

cause since it came on so suddenly and after vomiting the patient would have complete relief until the next attack. This view is further supported by the fact that on removing the strip of gauze at the end of 48 hours a gush of at least one half ounce of fluid flowed down, followed by complete cessation of the vomiting, except when it could be directly traced to other causes such as secretion dropping back into the mouth.

His polyuria returned after about ten days. Then it was noted that he had a marked acetoneuria which yielded largely under levulose and carbohydrate treatment. The polyuria also subsided rapidly.

An infection suggestive of an erysipelas developed in the face which subsided in a week. No other outward symptoms appeared. His eyesight began an immediate improvement. His headache disappeared on the third day and has not returned.

I am indebted to Dr. Cassius C. Westcott for the two charts denoting the changes in the fields after the operation and for the following notes upon the eye findings:

A W. American male was seen first at the age of 15 years on October 8, 1908 complaining of dimness of vision. He also complained of pain frontal and temporal radiating to the occiput. Photophobia and poor vision were helped in 1904 by securing glasses which he wore for 9 months.

At the time of examination (October 1908) he stated that his vision had become dim in the right eye six days previously and after two days had suddenly failed entirely. R. V., hand movements. L. V., 6/12. The right pupil exhibited no direct light reflex. The maculae were both very granular and the retinae were of the "shotsilk" type. No lesion was found to account for the poor vision.



has been no bony growth, his height has not changed, and no sexual change has occurred

#### SUMMARY

Patient was suffering from a cyst of the hypophysis, which had caused primarily the type of disease known as Frolich's syndrome, upon which had been superimposed an acute attack of brain pressure, with vomiting, headache and complete blindness due doubtless to a hæmorrhage into the cyst. The operation performed by the infranasal route, already described and used by myself, was successful in evacuating the cyst. The walls of the cyst were curetted and the cyst packed. The patient recovered and noted an immediate restoration of sight, practically complete in one eye and slight in the other. Headache and all signs of brain pressure disappeared and this freedom from difficulty has persisted for over two years. Meanwhile he has been fed upon varying doses of pituitary extract — at first of the anterior lobe, and later of the whole gland, in doses varying from 12 to 30 gr daily. There has been a distinct growth of hair upon the extremities and a slight growth upon the face, pubes, and axillæ. He has lost his excessive adiposity. There has



Fig 4 Stanley W. One year after operation.

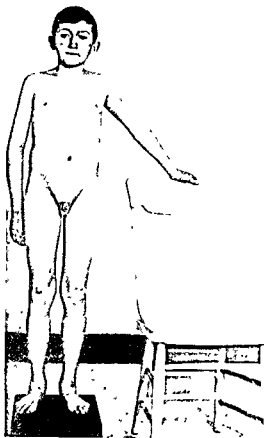


Fig 5 Stanley W. One year after operation

been no growth in height, nor any development of sexual functions, although his general appearance is tending toward that of the male. He is bright and capable of carrying on his work in a responsible position (Figs. 4 and 5).

A general review of the results reported to date by Cushing, Hirsch, von Eiselsberg, Hochenegg, A. E. Halstead, and others may be summarized briefly as follows:

*Prognosis as to life.* Of 45 cases operated upon by the supranasal route, 17 have died, a mortality of 37.8 per cent. Von Eiselsberg's mortality in the 12 cases was 25 per cent. The infranasal route, including the submucous modification, excluding Hirsch's cases, has given a mortality of about 21 per cent (36 cases, with 8 deaths). I myself have operated

upon 3 cases, with 1 death. Cushing's mortality has been about 13 per cent, while Hirsch in 26 cases has had 3 deaths, a mortality of 11.5 per cent. Such figures are not conclusive by any means, but they do indicate that the mortality rate is rapidly falling as our experience grows, and that soon we may be justified in operating upon those cases which fall into the elective group and not confine ourselves, as at present, to the operations of necessity.

*Prognosis as to ultimate results.* What, in various types of disease, may be looked for as the ultimate result? While it is too early to prognosticate this, a review of the literature as well as our experience would seem to indicate the following:

Cysts may be operated upon with particularly good results as to local pressure. That they may recur the experience of Horsley demonstrates. That they often do not is proved by my experience in the case reported, as well as that of von Eiselsberg, who reports two cases well two years after the operation. Hirsch has operated upon five cysts and states that they have good chances for amelioration of symptoms. The eye signs have been uniformly bettered unless complete nerve atrophy was present. The excessive adiposity has generally been lessened if the operative procedures have been supplemented by whole gland feeding. The sexual development has been little affected, although von Eiselsberg reports slight change in one case. Marked change in growth has not as yet been produced, even with gland feeding. The growth of hair and a tendency to change from the female to the male type has followed frequently if gland feeding was instituted.

Owing to the fact that acute pressure symptoms in these cases are due often to hemorrhage into a cyst, an absolutely bad prognosis cannot be given in those cases in which operation is refused since it has occurred that the hemorrhage has been absorbed and the evidence of acute pressure has disappeared. In these cases, and others not operated upon whole gland feeding may have some effect on the symptoms mentioned above, but certainly not as marked as in those cases operated upon and treated by subsequent feeding.

The results in operations upon acromegalies are not so definite, due possibly to the fact that operation has been performed after hyperpituitarism has produced its results and not at the inception of the disease.

There has generally been a recession of the swelling of the soft parts but no effect upon the bones. Menstruation has been restored in several cases (Hochenegg, von Eiselsberg), and Cushing reports the return of male sexual function one year after operation which was supplemented by gland feeding. The eyesight, when involved, has been favorably affected. There has not been a marked loss of weight, even with feeding. It is to be noted that these cases of acromegaly which have gone over into the state of hypopituitarism with mental symptoms seem to be markedly benefited by feeding without operation (Cushing). Sufficient observations have not accumulated to give us any data as to the effect upon growth in the incipient cases.

The effect in adiposis dolorosa, von Recklinghausen's disease, various dyspituitarisms, and allied conditions cannot be stated at this time.

*As to the type of tumor.* The favorable results in cysts has already been commented upon. The adenomata should be divided into two groups: those which have grown out of the sella and become intracranial, and those still intrasellar. In the former group, Hirsch reports upon 13 cases in which the local pressure was relieved with considerable improvement of vision and at times amelioration of certain general symptoms, but for the most part the operation may be described as palliative.

In the second group in which are often found the early acromegalies, there are often no typical signs and symptoms, atypical evidences, however, have caused a resort to the X-ray, and the bulging sella with a narrow outlet has confirmed the diagnosis. This is the type of case offering the greatest possibility of cure if attacked promptly. This possibility is emphasized by the brilliant result obtained by Halstead, in whose patient (suffering from an adenoma) there has been no return of the tumor after over 3 years. The malignant tumors are not common,

but when they do occur the outcome is of course, fatal.

#### GENERALIZATIONS

Generalizations make no claim to absolute correctness, they only mark the stages of our progress, and what is said to-day may be proved incorrect to-morrow. They may, however, direct the lines of advance.

*Choice of operation: intracranial versus transphenoidal.* At the present time one cannot say definitely which procedure will be the one of choice. Certain general principles can be laid down, however, and the lines of future work suggested.

The transphenoidal route cannot, unfortunately, be rendered absolutely aseptic, and therefore meningitis is always a possibility, although that menace is growing less as our experience accumulates. This route is not available for tumors lying in juxtaposition to the hypophysis and hence giving hypophyseal symptoms. Moreover one cannot remove all the tumor when it has extended widely outside of the sella turcica.

The intracranial route is not feasible for tumors confined to the sella turcica. It can be only palliative in a majority of cases, since it does not become the operation of choice until the tumor is far advanced, and in most cases it will be impossible to remove the part of the tumor lying in the sella turcica. Therefore we may say that tumors lying for the most part in the sella turcica should be reached by the infranasal route.

Cysts may be reached and drained by either route, but more permanent results may be hoped for from the transphenoidal route, since this affords room to grow and makes subsequent puncture and drainage easy.

Tumors that have surely grown beyond the sella turcica can be reached by the intracranial route. Neighborhood tumors may be reached in the same manner.

In this connection it should be remembered that the transphenoidal route gives a decompression opening, in case of future growth, for the local structures as well as for the brain, while the intracranial in a majority of cases gives relief for general brain pressure only. In general, then, in old cases in which palia-

tion only is sought the intracranial route is the operation of choice, in those in which we hope for permanent results we must use the transphenoidal, although the danger of infection is greater. It is to be hoped, however, that the future may suggest some intracranial route that will offer permanent relief with a minimum of danger.

*Choice of individual operation.* Not enough operations have been attempted by the intracranial method to choose between them. Horsley has apparently had good results with the approach through the middle fossa, although his immediate and ultimate results have not been published. The ingenious method of McArthur, the McArthur-Frazier, or that method combined with a preliminary Krause flap, would seem to offer many advantages in extensive growths.

Of the transphenoidal methods, an experience with three cases leads one to reiterate the statements previously made, namely, that the infranasal approach as described, or some of its modifications (Halstead, Hirsch, Cushing), should be the operation of choice. While all credit should be given to Schloffer, von Eiselsberg, Hochenegg and others who have operated earlier by the supranasal route, when one contrasts the ease and simplicity of the infranasal approach with the mutilation, difficulty, and added danger of infection of the supranasal, the latter will surely be abandoned.

Concerning the modifications of the infranasal route the labio-buccal incision of Halstead has given a most brilliant result in the hands of its originator and others. It has the advantage of leaving absolutely no scar upon the face, and the disadvantage of having the incision and operative field in the mouth. To avoid the increased danger of an aspiration pneumonia, Halstead has given his anaesthesia through a tracheotomy wound.

Making the incision in the crease under the nose has the advantage of having a field entirely outside of the mouth and the disadvantage of the scar, although in four cases which came under our observation this was invisible to ordinary inspection.

The operation of Fien is unnecessarily extensive.



The operation of Hirsch should receive most serious consideration. In those cases in which the tumor is small or a cyst is present, it is probable that the submucous operation can be done in stages with a minimum of danger. Yet where the nose is small or where we wish to remove as much of the tumor as is possible, a more extensive field will be found advisable. We would suggest in certain cases the possibility of cutting the basal attachment of the septum of the external nares and turning this aside. This would add materially to the room.

It is possible, of course, to add the submucous principle to any of the infranasal procedures.

*Indications for operation* The indications for operation in cases of hypophyseal disease may be classified as absolute and relative. Operation is absolutely indicated in those cases in which the tumor immediately jeopardizes the life of the individual or is causing progressive blindness. It is relatively demanded when, because of perverted or increased or decreased secretion, the well-being and ultimately the life of the individual is threatened. Therefore, if the tumor is growing rapidly or has grown to a large size, or if a cyst has suddenly filled, we will have pressure

symptoms both locally and generally that will imperatively demand intervention. As the safety of the operation increases the field of the relative demand will be broadened.

Just how far this will extend cannot be fully stated now, when our knowledge of the perverted states is limited. Thanks to the magnificent and painstaking work of Cushing, we have a basis at least upon which study may be made.

In general it may be stated that the adipogenic type of disease where an enlarged sella can be shown should be subjected to operation and fed with the whole gland. This is particularly true since so many of these cases, as shown by Lewis in his careful study, are associated with cysts, in which operation is most successful.

Acromegaly should be treated most conservatively, particularly since many of the cases have passed over into the stage of hypopituitarism. As the safety of the surgical procedures grows, operation should be attempted in the early stages of the disease, before the growth has left the sella. The more complicated and late cases and those with atypical signs should be treated medically until the results in the typical cases are well established.

## ECTOPIC PREGNANCY ASSOCIATED WITH ANOMALOUS FALLOPIAN TUBES

By O. V. HUFFMAN, M. D., NEW YORK CITY  
Pathologist, Sloane Hospital for Women

WE wish to report an exceptionally good specimen of ectopic pregnancy. This specimen, besides affording us opportunity to study the uterus, tubes, and ovaries with a view to finding some confirmation of the inflammation or obstruction theories, affords us some evidence for a new working hypothesis as to the cause of ectopic pregnancy.<sup>1</sup>

This hypothesis is that ectopic pregnancy is determined by an anomalous imbedding

area. At present we are unable to recognize the anatomical factors which are necessary to an imbedding area, but we can assume that the special tissue may become misplaced, during the development of the tubes and uterus, from the Müllerian ducts. The mutual relationship of imbedding area and fecundated ovum has been overlooked by most investigators in searching for the causes of ectopic pregnancy. The problem is physiological rather than mechanical. In the first place, why does the fecundated ovum under normal conditions imbed in the uterine mucosa?

<sup>1</sup> I wish to express my thanks to Professor F. C. Wood, Director of Cancer Research, Columbia University, for the courtesy of his laboratory library and assistance.

Certainly there must be a mutual relationship. Since the ovum does not imbed in the cervix. The distribution of placentation and imbedding areas is still better defined in some of the lower animals, as, for instance, the cotyledonary burrs of the cow and the Hollard *consinets* of the rabbit, which occur in the virgin uterine mucosa.

The difficulty in the study of tubal pregnancy is that we do not have an opportunity to examine the tube when the ovum is small, but only after it has grown and extensively altered the anatomy of the tube. The condition of the hyperplastic epithelium at the site of the ovum at this time cannot be considered a criterion of its condition before the ovum became imbedded, nor can investigators agree as to whether minor abnormalities at the site of the ovum are to be regarded as present before or caused by the growth of the ovum. Another practical difficulty in the study of ectopic pregnancy is the fact that many specimens are rendered worthless by the hemorrhage, rupture, and adhesions. But even with these difficulties, a sufficiently large number of cases have been observed where no obstruction or inflammatory condition could be found to account for the implantation of the ovum at the abnormal site.



Fig. 2. Diagram representing the anterior aspect of the left Fallopian tube near its outer end where it is bent downward and backward, being bound to the ovary by recent adhesions caused by the hemorrhage. Here on the anterior aspect there is an accessory tube, smaller and less perfectly formed than the accessory tube on the right side. Its free extremity is somewhat necrotic, having rested in blood clot. The lumen of the miniature tube does not communicate with that of the mature tube. Near the fimbriae there is a small subserous cyst.

Fig. 3. Diagram representing the anterior aspect of the fimbriated extremity of the right Fallopian tube 1.5 cm. distant from the mesoperitoneal junction on the anterosuperior aspect, there is a miniature accessory tube which presents a patent ostium abdominale but does not communicate with the fully developed tube.

For the specimen reported here (Figs. 1, 2, and 3) we are indebted to Dr. John H. Larkin, pathologist to the City Hospital, who removed the uterus, tubes, and adnexa *in toto* from the body of a woman who died as the result of hemorrhage following rupture of the tube. Here, as stated above, we were able to examine both tubes and the uterus. The ovum had become imbedded in the isthmus of the left tube, and in size corresponded to a gestation of about six weeks' duration. The fimbriated extremity of the left tube was attached to the left ovary, which contains a large corpus luteum, by some delicate adhesions which are apparently recent, having been caused in all probability by the blood which surrounded them. There was no hemorrhage within the lumen of the tube. The thin portion of the wall of the tube covering the ovum posteriorly presented a minute rupture, from which the hemorrhage had occurred. With the exception of the anomalies presently to be described, both tubes were normal.<sup>1</sup> The



Fig. 1. Photograph showing tumor in the left tube situated in the isthmus and caused by the growth of the ovum. The fimbriated extremity of the left tube is bound down to the left ovary, which contains a large corpus luteum verum. The adhesions are delicate. There is no evidence of hematosalpinx or pyosalpinx. The uterine cavity has been opened to show the decidua parietalis vera.

<sup>1</sup> For the microscopical examination special care was given to making a series of sections from the portion of the tube between the ovum and the uterine cavity to find if possible any obstruction which could hinder the progress of a normal ovum, and a series of sections from the tube at the site of the ovum and between it and the fimbriated extremity to find if possible any evidence of inflammation. The findings are negative and are in accord with the results obtained from the study of twenty-four specimens of tubal pregnancy received from Dr. Grace's service at the Moane Hospital and from Dr. F. C. Wood, director of the laboratories at St. Luke's Hospital of which we will speak later.

uterus was enlarged and was lined with decidua vera 0.5 cm in thickness. At this point we might regard the specimen as a case of ectopic pregnancy without anything to explain its cause.

We now come to the conditions which lead us to our hypothesis. Upon careful examination two rudimentary Fallopian tubes are observed, one attached to each of the fully developed apparently normal tubes near their imbricated extremities. These miniature accessory tubes are about 1 cm in length; they have imbricated extremities with ostia, but they do not communicate with the lumina of the large tubes. Their mucosa is thrown into folds and the epithelium is ciliated.

The explanation which we offer for the cause of this tubal pregnancy is based on the fact that each tube is congenitally malformed as indicated by a supernumerary tube near its outer end. The inference is that early in the embryological development of this particular individual there was a duplication of the Mullerian ducts, and it is not unreasonable to suppose that with retrogression or subsidence in the growth of the one pair, those portions which should have formed the second uterus with all the factors which determine an implantation area became fused as "rests" with the fully developed tubes, and that such a rest permitted the ovum to imbed. This theory was approached by Webster when he stated tentatively that the ovum can imbed only in Mullerian tissue capable of decidual reaction but today the implantation factors are not to be confused with the decidual cells which are regarded as protective to the maternal organism against the too extensive invasion of the trophoblast. Although it has been proved by experiment that obstruction alone cannot cause ectopic pregnancy, it is still to be kept in mind as a possible factor in holding back the ovum until the trophoderm is sufficiently developed to imbed in the anomalous receptive area, which is the real physiological cause.

As to the frequency of anomalous tubes we have no reliable data. Richards, some sixty years ago, called attention to the great frequency of accessory ostia, von Winckel has found malformed tubes rather rare. Doran, in

1887, published the results of his examination of 1,000 specimens, in which he found malformations present in 0.6 per cent. With more care and the use of microscopical methods, it is fair to assume that a much greater percentage of abnormal tubes would have been found. It is needless to say that a cursory examination does not reveal some of these anomalies. It requires the most diligent care to find them.

In addition to this unusually fine specimen, we have studied twenty-four specimens of tubal pregnancy removed by operation—sixteen from St. Luke's Hospital and eight from Sloane Hospital. In only nine of these twenty-four specimens was the anatomy of the tube sufficiently preserved to be examined for minor anomalies. In the other fifteen specimens the large size of the gestation, the rupture, blood clot, and adhesions, made it impossible to determine whether or not an anomaly existed.

The nine specimens which could be examined with certainty revealed the following anomalies in the pregnant tubes:

One with four accessory ostia

One with a small cyst at the imbricated extremity, to which is attached a small vascular cord, 1.5 cm long, being constricted at the attachment and surrounded by some free imbricæ. At the other end of this cord which hangs free, there is a small cyst, 1.5 mm.

One with an accessory ostium near its imbricated extremity.

One with an anomalous tubule on the anterior aspect of the broad ligament, and associated with three supernumerary ovaries.

Two specimens which did not reveal any anomaly in the pregnant tube were accompanied by the tubes from the opposite side, which were removed at the same time. One of these non-pregnant tubes had an accessory ostium and a pedunculated cyst near by and on top of the tube. The cyst contained caseous matter. The other non-pregnant tube was very short and, together with the ovary, rested on a parovarian cyst 5 cm in diameter.

Of the three apparently normal tubes, one was associated with an ovarian cyst, 5 cm in diameter, evidently derived from the rete ovarii.

Thus we see that in specimens which can

be examined, even with the difficulties mentioned above, more than fifty per cent have gross indications of malformation.

If we could obtain specimens for study when the ovum was quite small we might learn more. Recently, Rubin had the good fortune to obtain a specimen of tubal pregnancy where the ovum was very small. In studying the anatomy of this case Rubin regarded the ovum as arrested by a thickened muscular spur. This spur projected into the lumen of the tube just above an opening into a diverticulum. Here we believe the implantation of the ovum took place because of an anomalous imbedding area, and we consider the diverticulum simply an index to the abnormal condition of the tube.

In regard to the ovary, the only other organ in which the ovum is known to imbed outside of the uterus and tubes, this hypothesis is still applicable. Van Tussembroek, who gave us the first authoritative description of an ovarian pregnancy, described epithelioid cells of maternal origin near the ovum, and Webster, our leading authority on ectopic pregnancy, has stated his belief that the ovum must imbed in Mullerian tissue. In Van Tussembroek's specimen the Graafian follicle lined with lutein cells formed a cul-de-sac to the ovi-sac which was contained within the ovarian tissue. In the rupture of the Graafian follicle a small anomalous imbedding area which might have been included in the ovary could have been exposed and permitted implantation. We believe this is what occurred in her specimen. Webster's theory in regard to "rests" of decidual reacting cells, and his observations in support of it, support our theory as far as they go, but fail to account for those cases where no decidual cells are found. However, a few decidual cells might accompany the determining factor, and these might be destroyed by the trophoblast or overlooked when sought in the neighborhood of the ovum which has grown to gigantic proportions in comparison. Recently, Graham, in describing an ovarian pregnancy, pointed out that a separate remnant of the Fallopian tube was in the ovarian mass. He interpreted this, however, as having been twisted off and separated from the tube by

the growth of the ovum. In the only specimen of ovarian pregnancy which is in our laboratory the accompanying Fallopian tube is small, short, and straight, malformed—and rests on top of a large parovarian cyst.

In this paper we have confined our remarks to a discussion of objective evidence regardless of theories based upon clinical data. Werth has given us an admirable review of the literature and ample descriptions of tubal pregnancies. We have examined and studied twenty-six specimens of ectopic pregnancy, but of this number only ten could be examined with certainty for anomalies, and of these ten seven were associated with gross malformations. From the results of these studies we believe there is ample support for the theory that ectopic pregnancy is caused by imbedding areas which were mis-placed during the maldevelopment of the Mullerian duct.

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CERTAIN PROBLEMS AND PROCEDURES IN THE SURGERY OF THE SPINAL COLUMN<sup>1</sup>

BY CHARLES H. TRAZIL, M. D., PHILADELPHIA

OVERSHADOWED by the interest and publicity that have been given to the surgery of the cranial contents, the surgery of the spinal column until quite recently has not received the attention it deserves. In a comparative review of the lesions of the brain and of the spinal cord, one finds that there are more lesions of the cord which lend themselves to surgical intervention, and that for other reasons the cord offers a more fruitful field. The accessibility of the cord throughout its entire length and on every aspect is a point of advantage, and, other things being equal, the absence of important vital structures and other factors combine to make all properly conducted operative procedures upon the cord freer from risk than operations upon the cranial contents.

Of the operative treatment of fractures of the spine, volumes have been written and numberless opinions expressed, but without agreement as to the time or the propriety of operating in recent cases. Quite the most notable contribution to the subject was made to this congress a year ago by Allen, whose cleverly conducted experiments promised to open up a new era in the operative treatment of fractures and to sweep away the pessimism with which we have been beset. Allen found that the serious effects of contusion of the cord, such as might attend fracture or fracture dislocation, and such as would, if left untreated result in a complete permanent paraplegia, could be entirely relieved by a median incision in the cord at the site of the injury. The object of the incision was to allow the escape of the traumatic effusion, blood, and lymph, whose presence alone would result in the destruction of cord tissue. The results of Allen's experiments were so striking and brilliant as to deserve the careful consideration of surgeons. While the outcome of the first opera-

tion which I performed after Dr. Allen's experiments were completed was not pleasing, I regard the matter as of enough importance to place on record even an unsuccessful case. A young man fell from a roof and sustained a fracture of the mid dorsal vertebra. An examination within an hour of the accident revealed the signs of complete transverse lesion. Within five hours of the accident we exposed the cord and found it swollen and tense at the site of the injury. With the slender blade of a cataract knife an incision 1 cm long was made in the median line at the site of the contusion, and immediately there was a gush of bloody fluid which had evidently been retained under great tension—a condition analogous to that described by Allen. Four months have elapsed since the operation, and while there has been some return of sensation there has been as yet no return of muscular power. While failing in this instance to secure more pronounced results, I believe surgeons should give thoughtful consideration to this proposed measure of relief in what are otherwise hopeless cases, and should repeat the operation sufficiently often either to establish it as a means of restoring function or to prove its inefficacy. It is needless to say that the incision in the cord must be made in the precise way and with the precautions which Allen has indicated.

There are also occasions when, in late cases of spinal fracture, a laminectomy has been performed to advantage, either for the relief of pressure on the cord itself or upon the motor or sensory roots.

There is still much doubt and uncertainty as to the pathology of circumscribed spinal meningitis. In fact, there are some among the neuropathologists who question the existence of a strictly circumscribed process, and yet on the operating table I have seen a condition which corre-

<sup>1</sup> Read before the Third Clinical Congress of Surgeons of North America, New York City, November 22, 1913.

sponds with singular accuracy to that which has been described by others, and there is no doubt at all that the evacuation of the fluid in these cases is followed by the relief of symptoms.

Of tumors of the spinal cord and its membranes, very many more lend themselves to radical treatment than similar lesions of the brain, especially those taking their origin from the meninges, which in so many instances are encapsulated and easily removed in their entirety, and, while belonging to the malignant group, such as the fibrosarcomata or endotheliomata, tend to recur locally rather than to metastasize to other internal organs. Mention should be made of the contribution to the surgery of the intramedullary tumors by Elsberg, who observed the tendency to spontaneous extrusion of the tumor following incision of the overlying membranes.

I should like to refer particularly to the relief which may be afforded the excruciating pains of inoperable tumors of the spinal cord, no matter what their origin may be, and in this connection may allude to a case (File No. 11263, U. H.) referred to me by Dr. Mills, in which, upon the removal of the laminae of the sixth, seventh, and eighth dorsal vertebrae, an extensive metastatic lesion was uncovered involving the seventh dorsal vertebra, the dura, and the seventh and eighth dorsal roots (Fig. 1). That portion of the dura which was the seat of the malignant infiltration was removed, and the posterior roots of the seventh and eighth dorsal segments removed. Following this intervention, the patient has remained free from pain.

Section of the posterior or dorsal roots has been given wide publicity of late years through its application to the treatment of many conditions, notably through the brilliant results obtained by the distinguished speaker and guest of the evening in the treatment of spasticity. The latter problem has been so fully covered that I will not refer to my own experience in this connection, but speak only of the application of sensory root resection for the relief of pain. I have mentioned already the striking effect of division of the sensory roots in the relief of pain in a case of

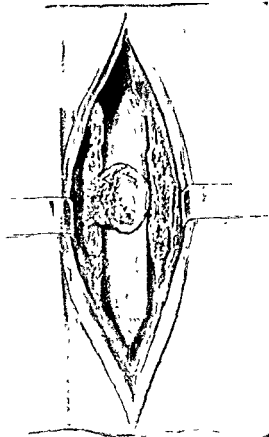


Fig. 1 Drawing from a photograph of a metastatic carcinoma of the dura which, after division of the posterior roots involved, was removed as a palliative procedure for the relief of pain.

an inoperable carcinoma of the vertebrae, and the efficacy of this measure should not be lost sight of in the insufferable pain that attends involvement of the brachial plexus either as the result of trauma or the extension of an inoperable carcinoma of the breast. I could cite instances of both, but one will suffice for illustration. An amputation (K. B. File, No. 67, P. E. H.) of the breast had been performed and local recurrence was rapid. When I saw the patient for the first time three years later, the upper extremity was swollen and cedematous and the patient complained bitterly of the pain night and day. There was a large recurrent mass in the axilla and supraclavicular region, and amputation would have been of no avail. With



Fig. 2. Photograph of patient who was entirely relieved of severe gastric crises by resection of the seventh, eighth, ninth and tenth posterior thoracic roots. Photograph shows area of anaesthesia.

her ready consent I divided through a unilateral laminectomy the dorsal roots of the fifth, sixth and seventh cervical and first and second dorsal nerves. The operation was performed at one of the clinics of the congress a year ago, and since that time the patient who has been under my observation ever since has enjoyed a measure of relief which more than justified the undertaking.

My experience justifies this undertaking further in the relief of the gastric crises of tabes when all other measures have failed. I say this advisedly, because, although the majority if not all of the underlying cord lesions are of luetic origin, there are certain cases which do not respond to the administration of mercury, but have been relieved by salvarsan or neosalvarsan. Within the past three months I have had two cases referred to me for operation because of the acute exacerbations of pain, in both of which the

pain was controlled by successive injections of salvarsan. The most striking result of root resection in my experience, of these cases where operation was undertaken as a last resort, was in the case of a middle-aged man (File No. 10,122, U. H.) who, one year before I saw him, had had an abdominal operation on the supposition that he was suffering from gall-stones. When he first came to me, the paroxysms, which recurred every four to six weeks, were excruciating in character (Fig. 2). The seventh, eighth, ninth, and tenth dorsal roots were divided through a unilateral opening, the vomiting and pain were entirely relieved, and there has been no recurrence. Although there have been recorded instances of recurrence, which I believe should be attributed to the failure to cut a sufficient number of roots, this operation though not new, has not been given the recognition it deserves as a measure of relief for the intractable cases where the patients often become morphin habitués and die as a result of prolonged suffering and starvation.

As for the plan of exposing and dividing the sensory roots, I am still of the opinion that the intradural is to be preferred to the extradural method. While theoretically the danger of infection is less when the dural sac is not opened, I have never had a case of meningitis develop by so doing, and there is no doubt but that the identification of the ventral roots and their separation from the dorsal is more readily and accurately effected while they are still within the dural membrane.

There is one phenomenon more than any other which has impressed me in resection of the sensory roots, namely the variability of the results. Whether in its effect upon spasticity upon the alleviation of pain, or in the resulting disturbance of sensation, there is a curious variability in the effects of resecting the same number of roots in any series of cases. To cite an extreme case in that of a patient with a brachial plexus injury, even after division of all the roots from which the brachial plexus derives its sensory supply, the sense of pain was not altogether relieved. In some cases, one finds a partial and in others a complete anaesthesia, in some

it is transitory and in others permanent, and again in others it is a hyperæsthesia. These widely varying phenomena would seem to throw some doubt upon the present conception of the pathways of all afferent impulses, and at once suggest a field for investigation and inquiry as to whether the ventral roots do not play some part in the carrying of afferent impulses.

While to the sensory roots so much attention has been given in the variety of conditions to which allusion has already been made, the possibility of utilizing the motor or ventral roots of the cord has barely been touched upon. My interest in this phase of spinal surgery was first aroused in association with Dr. Charles K. Mills, in the treatment of a patient who had sustained an injury to the cord which had left him with a residual paralysis of the bladder, with absolute incontinence and the inevitable cystitis. The question arose as to whether by an intradural anastomosis of the ventral roots innervation to the muscles of the bladder could not be restored. Investigating the nervous supply of the bladder, we found through the researches of Frankl Hochwart<sup>1</sup> that the bladder has two or three sources of supply, and that one of these was through the third and fourth sacral segments and roots. On the cadaver, we found that the twelfth thoracic or first lumbar, if divided at their points of exit from the spinal canal, could be brought into contact with the third and fourth sacral roots in the cauda equina. Finally it was decided to attempt to effect such an anastomosis in our patient (Fig. 3). The laminae of the twelfth thoracic and first and second lumbar vertebrae were removed and the first lumbar ventral root was divided at its point of exit from the cord. To identify the sacral roots, the electrode was called into play. The second sacral root was identified by the movements of the toe which followed faradization (Fig. 4). The next two roots, that is the third and fourth, were then divided, and an end-to-end anastomosis with the first lumbar effected with the finest Chinese silk. The divided nerves appeared to be in perfect

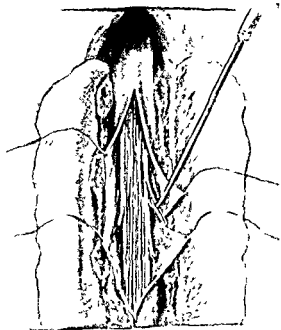


Fig. 3. Operation for anastomosis of the roots within the dural sac, showing transverse slit in the dura to expose the first lumbar root at its point of exit from the vertebral canal.

contact and they were under no tension. Four months after the operation the patient reported that he was able to retain urine for a period of two and a half hours, and that there was some expulsive power of the bladder. Eight months after the operation a further report stated that now he could dispense with the urinal, which he had hitherto worn constantly, for a period of twelve hours, and that with the assistance of pressure over the suprapubic region partial evacuation of the bladder was possible. An inquiry into the literature touching upon the subject revealed but one pertinent contribution. Kilvington had already conceived the principle of this operation and had conducted a series of investigations upon dogs, in which he observed that when the last lumbar was joined to the second and third sacral roots, electrical stimulation produced all the effects which followed stimulation on the untouched side.

For the purpose of securing physiological data which would place upon a scientific basis the procedure of intradural root anastomosis,

<sup>1</sup>Frankl Hochwart and Zuckerkandl. Die nervösen Erkrankungen der Harnblase. Wien 1906.



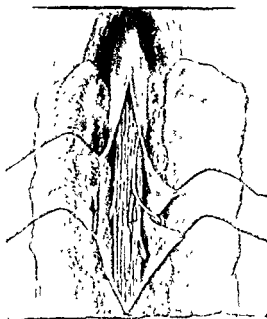


Fig. 4. Operation for anastomosis of the roots with n the dorsal sac. showing end to end anastomosis b between the first lumbar ventral roots and the third and fourth sacral

a series of three operations were conducted in my laboratory by Dr A B Eisenbrey. In one there was no restoration of function, in a second a cross anastomosis was made on one side between the third and fourth lumbar roots. As a result of an electrical examination made, Dr A R Allen reported that the

muscles responded to both faradic and galvanic stimulation, that there is an evident condition of restitution, and that in the course of a short time the reactions of degeneration now barely demonstrable will probably have disappeared. In a third observation, in which the sixth lumbar left was anastomosed with the sixth lumbar right, Allen reported that it was difficult to determine any difference between anodal and cathodal contraction in the affected muscles.

These experiments and clinical phenomena are presented with the full understanding that they are in the nature of a preliminary report. The histological examination of the tissues removed from the experimental series and the further developments in the single clinical observation will place the operation on a more substantial footing. Suffice it to say now that the evidence, experimental and clinical, is favorable to our contention. Were we to attempt to forecast the possible indications of this operation, a number of lesions would at once suggest themselves, including not only the paralyses that follow trauma of the cord, but the terminal paralyses of poliomyelitis. An investigation upon the cadaver has shown, as will be seen in the table, the numerous combinations, unilateral and crossed anastomoses, that would be possible (see table).

These investigations will be continued to definitely establish the utility of these

VENTRAL ROOT ANASTOMOSES

	Above			Below				Opposite		
	Cervical	Dorsal	Lumbar	Cervical	Dorsal	Lumbar	Sacral	Dorsal	Lumbar	Sacral
Cervical				6*						
5				7†						
6				8†						
7					1†					
8										
Dorsal	7* 8									
2	8†	1			2			1*		
3		1 2			3			2 3 4 5		
4		1 2 3			4			3 4 5 6*		
5		2 3 4			5			4 5 6 7*		
6		3 4 5			6			5 6 7 8		
7		3 4 5 6			7			6 7 8 9		
8		4 5 6 7						7 8 9 10		
9		5 6 7 8						8 9 10 11		
10		6 7 8 9						9 10 11 12		
11		6* 9 10 11			12	1			2	
12		8† 9 10 11								
13		8† 9 10 11 12				2 3 4		10 11 12	1 2 3 4* 5	1 2
Lumbar						3 4 5	1 2 3	11 12	2 3 4 5	1 2
2						4 5	2 3 1	12 12	1 2 3 4 5	1 2 3
3							3 2 1	10 11 12	1 2 3 4 5	1 2 3
4							1 2 1	10 11 12	1 2 3 4 5	1 2 3
5*								10 11 12	1 2 3 4 5	1 2 3

\* Barely † Easily ‡ Just § Readily \*\* 21 cm. in length

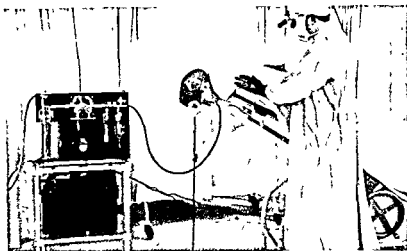


Fig 5 Showing position of patient for operation in the midthoracic region the ether being administered by the intratracheal insufflation method

measures and their applicability to these and other diseases.

As has been said surgery of the spinal cord offers a more fruitful field than that of the brain and at the same time should be attended with a lower percentage of fatalities. In my own experience, and I am quite sure there are many here whose experience in the question of mortality corresponds with mine, there have been but two deaths following operations for a great variety of lesions, including tumors, spasticity, gastric crises, traumatism, and paralyzes. One of these was a case of multiple and inoperable sarcomata of the spinal cord and the other a case of spasticity in a child of low grade mentality. The latter belong to a class which is notable for their lack of tolerance of operative intervention, and in which operative intervention should be practiced only in exceptional cases. To reduce one's mortality to a minimum, certain factors of safety should be taken advantage of. That the free escape of cerebrospinal fluid throughout the operation exerts a harmful influence is, I believe, an erroneous impression and one unfounded upon any scientific data. It is, however, disturbing to the operator to have the field of operation constantly bathed in fluid; and to arrest its escape one should take advantage of posture by keeping the head

lower than the region of the cord uncovered, and at the same time prevent the escape of cerebrospinal fluid by introducing a plug of cotton between the dura and cord proximal and distal to the seat of operation.

Some operations upon the cord, such, for example, as that of intradural anastomosis,

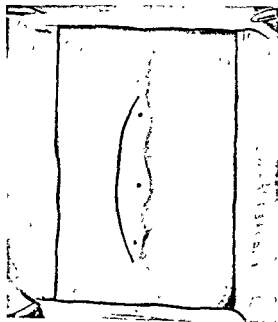


Fig 6 Showing general direction of the cutaneous incision with relation to the spinous processes



Fig. 4. Photograph taken during operation showing introduction of pledget of gauze behind the dural flap for hemostatic purposes. Head held in position by traction sutures while gauze is being introduced.

may be somewhat tedious and prolonged. For this reason, certain precautions are desirable to avoid such complications as may arise from the administration of the anesthetic. I am quite convinced that with patients in the face down position, the respiratory function under the relaxation of deep anesthesia is impaired. The weight of the body itself offers an impediment to the free respiratory function and under surgical anesthesia the loss of muscular tone is a well known physiological fact. For these reasons which may be regarded as reasonable explanations, the patient in the prone position in prolonged anesthesia shows signs of respiratory distress. The improvement which follows a change to the lateral position may be offered as further evidence of the effect of position upon respiration. To place the matter upon a more scientific foundation, we have been investigating the problem by measuring the amount of expired air with a Bohr gasometer and while time will not allow of a detailed account of the results of these investigations suffice it to say that a comparative study of cases has revealed the interesting and significant fact that the amount of expired air in the dorsal position is greater than that in the face-down position approximately in the ratio of 10 to 6. With these clinical and physiological data before

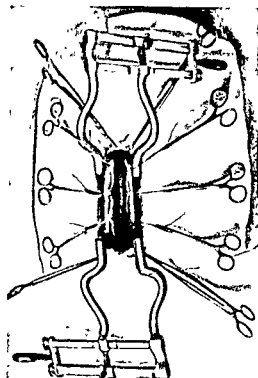


Fig. 5. Showing field of operation. Note use of self retaining retractors, the traction sutures introduced in the margins of the dura and the pledgets of gauze behind the dural flaps to control oozing and to keep the field of operation dry.

us, it is at once apparent that in spinal cases, Meltzer's method of anesthesia by intratracheal insufflation is specifically indicated (Fig. 5) and we have therefore adopted it as a routine procedure and have come to regard it as a very important factor in reducing the risks attending these operations.

There are other matters in the technique which are at least deserving of mention. The two stage operation is rarely necessary. We have resorted to it in but one instance. The muscular layer should be exposed by reflecting a semilunar cutaneous flap (Fig. 6) so that the line of the cutaneous incision does not correspond with that in the aponeurosis, thereby lessening the risk of a direct fistulous connection with the spinal canal. The muscles should be separated from the spinous processes, not with a blunt but with a sharp instrument, such as a chisel or osteo-

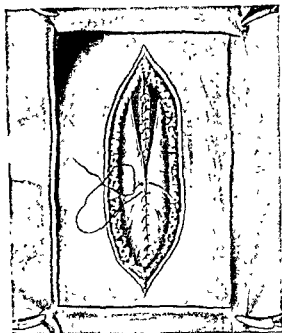


Fig. 9 In closing the wound two layers of buried sutures are used, one through the sheath of the erector spinae muscles and the other through the intravertebral aponeurosis. The latter is the stronger of the two, and therefore the more important structure.

tome. A unilateral laminectomy has no advantages and does not give an exposure adequate for thorough exploration or intraspinal manipulation, self-retaining retractors are convenient and permit of the continuation of the operation without assistance (Fig. 7); small tampons introduced behind each of the dural flaps, which are retained in a convenient place with traction sutures, will control bleeding from the two most constant sources (Fig. 8), the cut surfaces of the laminae and the spinal plexus of veins, and keep the field of operation dry throughout the operation. At its conclusion the dura should be closed with a continuous watertight silk suture so as to prevent leakage and the establishment of a cerebrospinal fistula, to secure proper coaptation in the muscular structures, three tiers of sutures should be used; the first, interrupted splint sutures to bring the belly of the muscles into apposition and provide proper protection to the spinal canal; the second, a continuous catgut suture in the sheath of the erector spinae muscles

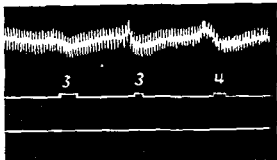


Fig. a

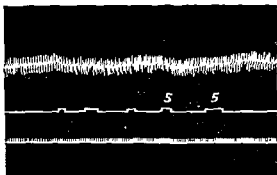


Fig. b.

Fig. 10 (a) Showing effect on blood pressure of electrical stimulation of ventral roots before application of stavain. (b) Showing negative results upon blood pressure of electrical stimulation of ventral roots after application of stavain.

(Fig. 9), and the third, in the stronger vertebral aponeurosis or aponeurosis of the latissimus dorsi muscle. Through a stab wound, a drainage tube is introduced to provide for oozing and is removed in eighteen hours.

While the method of exposure and the method of closing the wound are matters of some moment, the intraspinal manipulations are obviously the most important, require the most delicately conducted movements, and at the same time are pregnant with harmful possibilities. While it has been said (though of the truth of this point I am not wholly convinced) that manipulations of the brain ipso facto do not create harmful impressions, it is undoubtedly true that trauma of the cord, and more particularly of the dorsal or ventral roots, is distinctly harmful. This is not a mere speculation, but is founded on clinical observations and is confirmed by

Crile's contribution to the etiology of shock, in which he has shown that the vasomotor center may be depressed, if not exhausted, by harmful afferent impulses. There could be no more potent method of so affecting the vasomotor center than the manipulations of the ventral roots attending some of these intraspinal procedures. The identification of the roots in the cauda equina and the separation of ventral from dorsal roots undoubtedly have a damaging influence. On one occasion, particularly, while attempting to differentiate from one another the component roots of the conus, which is a rather tedious matter, the patient exhibited signs of serious circulatory disturbance which could be attributed to no other factor. It is important, therefore, to introduce into our technique something to safeguard the patient against the possible serious, if not fatal, effects of these intradural manipulations, and to this end, I have found that an effective block may be established by the application to the

cord just above the seat of the operation of a four per cent. stovain solution. In repeating the operation upon an animal under full anæsthesia, we found that without stovain the initial stimulation of the ventral root was followed by a transitory rise in blood pressure, but that after application of stovain, faradization of the roots had no effect whatsoever upon blood pressure, the stovain having blocked the passage of any impulse (Fig 10).

With these precautionary measures, with the attention to the problem of anæsthesia, with the stovain block, and with due regard to other features of the technique already mentioned, we have come to regard the operation of laminectomy and the accompanying intraspinal procedures with little apprehension, and have so reduced the mortality as to place the operation on a par, from the standpoint of safety, with the exploratory celiotomy and many of the more common intra-abdominal procedures.

## PROCTOCLYSIS—AN EXPERIMENTAL STUDY<sup>1</sup>

By HUGH H. TROUT, M. D., ROANOKE, VIRGINIA

**A** PRELIMINARY announcement of this experimental work was first reported February 12, 1912. Since this time the facts contained therein have been further confirmed by an increased number of cases, and more information ascertained.

A brief synopsis of this primary report is about as follows: The work started with the idea of comparing the effects of plain tap water as against normal saline solution per rectum, and this series covered nearly 1,000 cases.

The present report contains a few over 2,000 cases. In other words, every patient who has an operation is given, by rectum, either tap water or normal saline solution. Of course, operations on the rectum and perineum have to be excluded from using proctoclysis. With these exceptions this list contains a vast majority of all the operations of surgery and gynecology, and it is interesting

to notice by alternating the cases as they leave the operating room how evenly they are divided into different classes in the final summary.

The anæsthetics have been nitrous oxide and oxygen, ether, chloroform, and cocaine.

The method of proctoclysis is the same as described by Murphy, except in the place of the hard rubber nozzle we employ a small soft rubber catheter and count the drops per minute by means of a visible dropper, first described by Lawson (1).

We have not been able to introduce the large amounts of water, or normal saline solution such as Murphy (2) reports (nine quarts in 24 hours), except in a few of our drainage cases and in patients whose resistant power was so lowered that the hard rubber plug was not painful. In the vast majority of our cases the presence of the soft rubber catheter was not even known to the patient.

<sup>1</sup>Read before the Southern Surgical and Gynecological Association, December 18, 1912.

Inquiry has been made of most of the larger hospitals in this country both as to the method of preparing normal saline solution as well as their reasons for using the same in the place of plain tap water for proctoclysis. Replies were received from 232 hospitals, and the manner of preparation varies from careful attention to the most minute detail and containing potassium, calcium, and sodium chloride in varying proportions, filtered and sterilized, to the simple placing of two teaspoonfuls of table salt to one quart of tap water. In other words, the replies show there is no uniformity in preparation, and in most of them the solution is not isotonic with blood. A teaspoonful of salt may be anything from 115 grains to 270 grains, depending upon whether it is "heaping" or "level" or anything in between the two.

Taking a series of tubes, each containing 2 cc of sodium chloride solution of strengths varying from 1 per cent to 5 per cent, and placing in each one drop of blood, we find hemolysis occurs very sharply at two limits, the lower being between 50 per cent and .35 per cent, the higher being between 11 per cent and 12 per cent. Apparently hemolysis takes place at the lower limit by first liberating the hemoglobin, which is followed by the destruction of the cell; while at the upper limit there is first crenation and finally destruction of the cell. Mention of this is made simply to call attention to the fact of so many solutions being employed intravenously which are far removed from safe limits. This statement is based on the replies from a number of hospitals, indicating the employment of the same strength solutions intravenously as by rectum.

Following the directions of preparations given by the majority, and using the amount of fluid said to be absorbed from the rectum by many, we would be forcing into an already weakened patient, in the space of 24 hours, the average amount of salt consumed as a condiment by a normal man in one month. Some replies contend salt solution is less irritating to the rectum, but we find the reverse to be true.

The vast majority of the replies indicate the necessity for a chemical similarity or

isotonicity with blood. Of course, if osmosis plays any part in absorption from the rectum, which the majority of authorities deny, the higher the tonicity of the blood and the lower that of the solution, the quicker will the solution be absorbed. One reply suggested water might "dissolve out the salts from the cells of the epithelium, which takes on water to such a degree that the cells themselves actually burst. Salt solution prevents this and is absorbed without any destruction of the epithelium." This theory is not based on any experimental work or proof of any kind. We have now employed water in over 1,000 cases, and in no case have we been able to see anything to indicate a destruction or irritation of the epithelium.

Even we surgeons know of the wonderful improvement in some patients with nephritis when placed on a salt-free diet, and all of us realize there is a transient renal irritation or possibly a nephritis following the majority of anesthetics and infections. In 7 cases in our series the following coincidence has been observed: a transient albuminuria remained in every specimen for two days after an anesthetic when using salt solution per rectum. Water was then substituted, and at the end of 24 hours the albumin had disappeared. At this time a return was made to salt solution, with the appearance of albumin and a few hyalin casts in from 6 to 24 hours. Patients were then placed on a limited salt diet, and the urine in every case promptly returned to normal and remained so until discharged from the hospital. In none of these cases was there any edema.

An attempt was made to ascertain if there was any difference in either the time of appearance or amount recovered after giving a hypodermic of phenosulphophthalein (Roundtree-Gerherty method), after first obtaining what was apparently normal for that individual patient and then giving first water and later salt solution by rectum, and vice versa. In all our cases both factors remained practically constant, but our experience is far too limited to justify any final deductions on this point.

The estimation of the sodium chloride content, both in the blood and urine, presents too

many uncertainties to be of any practical value

The association between sodium chloride and the kidneys is too well known to require further comment

Personally we believe surgeons have simply drifted into employing salt solution by rectum without giving any serious consideration to what they were doing and such is our excuse for this paper

In this entire series in both the salt and water cases there have only been 121 who complained of being thirsty and of this number 112 of them were salt cases. There were 27 or over one fourth of these cases complained of tasting salt, when they had absolutely no way to know they were being given saline by rectum and the solution being prepared so as to be six tenths to nine tenths per cent sodium chloride. Furthermore, the water cases have taken one third more fluid by rectum than the salt cases, and the latter have required nearly twice as much water by mouth to relieve thirst

In addition to this there have been 58 cases who have been previously operated upon one or more times in other hospitals and they have all commented without suggestion, on the absence of thirst and decrease in nausea which were the prominent features of the previous operation, from the patient's view point. Of this series, 32 were given water and 26 salt solution per rectum

During the time of this series there have been 287 operations upon the rectum and perineum which have been under exactly the same routine with the exception of not employing proctoclysis and with the exception of 5, they have all complained bitterly of thirst

We can see no more reason for the giving of salt solution by rectum to prevent and relieve

thirst than we can for its employment by mouth under like conditions, and furthermore, we have noticed that when given by rectum it sometimes produces the same nauseating and slightly toxic effects it does after drinking

There have been two cases reported in the literature which have terminated fatally by employing a strong stock solution of sodium chloride, carelessly substituted for the physiologic solution, and Evans (4) reports two additional cases in which death was actually produced by the use of the physiologic salt solution

It is true sodium chloride is the least toxic of the group of similar metal chlorides, but even at that it is a poison to all people when given in large doses and occasionally very toxic in small doses to a certain class of cases; and we believe this peculiarity is apt to be present in patients whose resisting powers are lowered by operations and infections.

Certainly our observations convince us this is not only a theoretical but a most practical fact, and one worthy of more consideration than has been usually given to it in the past

Finally we know the giving of fluid by rectum meets Nature's post operative demand for the relief of thirst in a simple, effective and harmless manner, and to those of us who have been operated upon no other comment is necessary, to those who have yet to be operated upon, let us hope they will be spared the usual appeals for water, by insisting upon the employment of proctoclysis

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THE PRESENT STATUS OF THE RADICAL ABDOMINAL OPERATION FOR CANCER OF THE UTERUS<sup>1</sup>

By REUBEN PETERSON, M D, ANN ARBOR, MICHIGAN  
 Professor of Obstetrics and Gynecology University of Michigan

ON the whole it can be pretty definitely asserted that the radical abdominal operation for cancer of the uterus has never been and is not now commonly performed by American surgeons. Since it cannot be claimed that our operators are either less skillful or less intelligent than surgeons in other parts of the world, perforce there must be another explanation for the failure of the operation to become popular in this country. It will be the purpose of this paper to look at the question from a number of standpoints, with a view of determining the reasons for the unpopularity of the operation, with a plea for a change of conditions, so that the operation under consideration may be more universally employed. For in spite of the discouragement which comes from not being able to make the primary and end results of the radical abdominal operation for cancer of the uterus all that could be desired, I am still a firm believer in the operation, which I perform whenever the opportunity arises, in preference to other methods of treatment.

The principal reason for the unpopularity in this country of the radical abdominal operation for uterine cancer is its high primary mortality. Surgeons are not accustomed, in these days of highly perfected technique, to a primary mortality of from twenty to fifty per cent, which would be a fair estimate of the mortality of the radical abdominal operation, if all reported and unreported cases could be collected. Surgeons necessarily must be content with such a high mortality in emergency operations neglected cases where the knife holds out the only hope of saving life. Under such circumstances the surgeon consoles himself with the thought that without operation it is sure death for the patient within a few hours or days, and that every life saved is so much gain. However, it is different in the case of the woman with cancer of the uterus, who is able to walk to the operating room.

Such a high primary mortality as has been mentioned in such cases dismays even the most unemotional surgeon, and makes him query if after all he is justified in continuing with an operation which carries with it such disastrous primary results. If to this doubt be added a secondary mortality by no means low from a recurrence of the cancer, it is not to be wondered at if the surgeon abandon the operation upon what to him seems logical grounds and returns to the safer palliative procedure. I am firmly convinced that, for the reasons set forth above, the personal equation has had much to do with the abandonment of the radical abdominal operation for uterine cancer by American operators. And until two things have been brought about, I believe the operation under discussion will not be generally adopted. First, the profession and laity must be so educated regarding uterine cancer that the disease will be recognized earlier and patients come to the surgeon when local and general conditions combine to bring about a low primary mortality. Second, for this particular operation true specialization must result, so that the occasional operator will be eliminated.

The profession has been singularly backward in inaugurating the campaign against carcinoma. It has held aloof for a number of reasons, prominent among which has been the uncertainty as to the value of the knife as a means of cure. This doubt on the part of the great body of physicians has its origin in the poor surgical results obtained two or three decades ago from imperfect or incomplete operations, where the local disease was not entirely removed. A so-called recurrence after an amputation of a breast for cancer when the axillary glands are not removed in reality is not a recurrence but a continuation of the disease. The same will apply to cancer wherever situated. But no matter how faulty the reasoning, once let an idea become firmly fixed in

<sup>1</sup> Read before the Western Surgical Association, December 21, 1913.



the mind of the medical body politic, there it sticks until dislodged by long and continuous efforts on the part of those who have had better opportunities for judging the true condition of affairs.

The pertinacity with which the profession clings to a totally wrong medical conception is illustrated by the erroneous ideas regarding fibroid tumors of the uterus even now existing to a certain extent. For years it was taught that it was best to tide the woman with a fibroid tumor over the menopause, in the hope that all symptoms would cease after the cessation of menstruation. Time has shown this hope to be without foundation in the large majority of cases. Not only is it true that usually the growth does not shrink nor other symptoms such as increased flow cease, but the woman is exposed to other dangers even more serious, such as carcinoma of the body of the uterus. Yet so firmly was this idea of the beneficial action of the menopause upon uterine fibroids fixed in the minds of the profession, and through them the public, that many a poor woman's life is jeopardized even at this late day through adherence to this faulty treatment.

Hence, first of all we ourselves must be convinced that cancer is a local disease and capable of cure if taken in time, and radically removed. Otherwise we can never hope to convince our patients and the public in general that there is any cure for cancer.

That this surgical association and others of a similar nature have not long ago united in a campaign against cancer can only be explained upon the basis of there being something which has prevented surgeons, as a body, from beginning the attack. What are the reasons which have held us back when we have seen the great benefits resulting from the anti tuberculosis campaign? It could not have been that we minimized the importance of cancer in its various forms, for we have known for some time that in certain communities the death rate from cancer exceeds that from tuberculosis. Nor could it have been because we have not had opportunities of seeing and studying the disease, for from the very nature of the case, the surgeon sees sooner or later the vast majority of patients suffering from

cancer. Our hesitancy to inaugurate a cancer campaign is probably due to the fact that, unlike tuberculosis, the cause of cancer is still shrouded in mystery, and for that reason we are not in as good a position to enlighten the public as to how the disease is to be avoided. That this is true can be indirectly demonstrated by considering what would happen should the cause of cancer be discovered within the next month. Within six months there would be inaugurated a campaign against the disease fully equaling if not surpassing the crusade against tuberculosis. The medical and lay journals would be filled with matters pertaining to the subject, and people would be taught how to avoid this disease which for so many years, in the public mind, has meant sure death for its possessor.

As a profession, we certainly have been remiss in not doing what we can to mitigate the ravages of cancer. While not abating a single effort to ascertain the cause of the disease, surely it is our duty, individually and collectively, to save by early diagnosis and by surgical means as many of the victims of cancer as we possibly can. Let the people be taught the early symptoms of carcinoma of the uterus, and the results of the operative treatment would soon be improved. If cancer at first be a local disease, as most of us believe, there must be a time when local treatment, even without glandular removal will result in cure. The impossibility of determining from appearances or macroscopic examination just how long the smallest cancerous lesion has existed, or just how far it has extended, will always stand in the way of our remaining satisfied with anything short of radical removal of the disease. But the radical removal because of the possibility of extension discoverable only through the aid of the microscope, and removal where the gross appearances indicate that the cancerous process has attacked the surrounding tissues, are entirely different. Radical operation under the former conditions can be so perfected as to insure an exceedingly low primary mortality and excellent permanent results; in the other class of cases the primary mortality must always be high and permanent results poor on account of recurrences.

Thus, the present status of the radical

operation for cancer of the uterus, at least in this country, is directly dependent upon early diagnosis of the disease under consideration. In my opinion, unless patients can be operated upon earlier, we have about reached the limit of what can be accomplished by the operation, except as the primary and end results may be improved somewhat as the technical skill of individual operators be increased. This statement has reference to the percentage of absolute cures which is the reduction to one figure of the ratio between the number of cases of cancer of the uterus seen during a given period and the number of patients operated upon by the radical abdominal method who are alive and free from recurrence after five years. Winter has reduced this to a formula  $\frac{O \times D}{100}$  where O

denotes the number of patients operated upon out of 100 seeking relief and D denotes the number of patients remaining healthy out of 100 operated upon. If then in this country we have almost reached the limit of what can be accomplished by the radical abdominal operation for cancer of the uterus, or in fact by any operation with the cancer material as it is at the present time, the only way the percentage of absolute cures can be raised is by increasing the value of O or the number of patients with cancer of the uterus we are able to operate upon by the method under consideration.

Under the more enlightened conditions of cancer education prevailing abroad, it has been possible to obtain from 20 to 30 per cent. of absolute cures of the total number of patients with cancer of the uterus seeking relief. Stated in another way, this would mean that one out of every four women with cancer of the cervix seeking relief can be subjected to the radical abdominal operation, and will be free from the disease at the expiration of five years. That surely is something to be striven for when one reflects upon the small number of patients he has been able to save out of the total number he has seen in a given number of years.

In other papers I have gone into the various aspects of the radical abdominal operation for cancer of the uterus. I have reported my results carefully, my successes and failures. Others have done the same, so that there is now an extensive literature upon the subject. To the unprejudiced mind it has been demonstrated that cancer of the cervix can be cured in a considerable percentage of cases provided the patients are seen early enough and the operation is sufficiently extensive. But the fact remains that our results in this country, both primary and permanent, are exceedingly poor, and that it is time we began the campaign of education on carcinoma in general, and, because of its great frequency, cancer of the uterus in particular. While primarily this paper is a plea for the necessity of early recognition of cancer of the uterus, in order that the status of the radical operation may be improved, it seems to me it is the duty of this society to broaden the campaign so that it will include all kinds of carcinoma which can be benefited by surgery. In other words, I would have this society, through a committee appointed at this meeting, devise some plan by which it would be possible to secure co-operative action upon this question by all the special surgical and gynecological societies in America, including the surgical and gynecological sections of the American Medical Association. After the whole subject has been thoroughly gone into and the plan of action determined upon, it will be a very easy matter to interest the various state societies in the question. Just how the matter should be worked out is not particularly important here. The main things to be emphasized are: the poor results now obtained in the operative treatment of carcinoma, the possibility of improving the results of such treatment by earlier recognition of the disease by both the profession and the laity; the necessity of inaugurating a campaign of education on carcinoma through committees from the various national surgical and gynecological societies; and finally the desirability of having this society be the pioneer in this movement.

# DEPARTMENT OF TECHNIQUE

## SOME OBSERVATIONS ON THE ANATOMY OF THE INGUINAL REGION, WITH SPECIAL REFERENCE TO ABSENCE OF THE CONJOINED TENDON<sup>1</sup>

By WILLIAM HESSERT, M. D., CHICAGO

**E**VEN a cursory examination of the voluminous literature which has accumulated on the subject of inguinal hernia would seemingly convince anyone that in this branch of surgery the last word has been spoken. The anatomy is well known and classically described in the current text-books. The pathology has been amply described, and the etiology is generally admitted to be based on the presence of a congenitally preformed sac. The technique has been made more uniform and is guided by certain broad underlying principles. It would seem, then, that there is no phase of the subject of hernia which has not been amply treated by the ablest of writers. Yet this is not strictly the case, for there is a matter of anatomy, generally slighted which in my opinion is worthy of special mention. I refer to the question of the presence or absence of the conjoined tendon of the internal oblique and transversalis muscles.

In the prevailing text-books on anatomy the conjoined tendon is described but not accorded much prominence. Here and there it will be stated incidentally that the tendon may be absent. Reference to the more important works on surgery and monographs on hernia fails to elicit much information regarding the conjoined tendon. Here and there a writer will briefly mention the fact that sometimes the tendon is absent. Thus the impression is gained that such an anomaly as absence of the conjoined tendon may occur, but has no practical significance.

My experience has developed the conviction that absence or maldevelopment of the conjoined tendon is not as rare as one would be led to believe by what has been written on the subject, and that the question is deserving of some notice. I am sure that many surgeons have made similar observations, but it is also probably true that many have been operating, possibly for years, and have never given the matter any attention.

Let us first review the normal anatomy of the

inguinal region. The inguinal canal is about 4 cm. in length and runs from the external to the internal abdominal ring. The external ring barely admits the tip of the index finger, it lies immediately to the outside and above the spine of the pubis. It is formed by a splitting of the fibers of the external oblique aponeurosis into two columns or pillars. The internal ring is about midway between the antero-superior spine of the ilium and spine of the pubis.

The inguinal canal has an anterior and a posterior wall, a roof, and a floor. The anterior wall is formed by the aponeurosis of the external oblique and by the internal oblique for about its outer third. The internal oblique and transversalis muscles arise in the male from a little more than the outer half of Poupart's ligament, sometimes even from the outer two thirds. In the female the origin is more regularly from the outer two thirds. In some individuals the muscles arise from the outer third of the ligament, thus affording no support to the internal ring, a point emphasized by the late Dr. Ferguson. The posterior wall of the canal is formed by the transversalis fascia and at its outer median portion by the conjoined tendon. The roof is formed by the arching fibers of the internal oblique and transversalis muscles, and the floor by the shelving portion of Poupart's ligament.

The conjoined tendon is formed by the aponeurosis of the transversalis, together with the more medial lower portion of the internal oblique, these two layers of fascia uniting in this region to form this so-called conjoined tendon, which is inserted into the body and superior ramus of the pubis. Medially it is especially thickened to form a band, the *fals inguinalis*, which is firmly attached to the tendon of the rectus.

By closely observing the anatomy of this region during the performance of hernia operations one will soon be convinced of the frequency with which deviations from the normal occur. The

tendon is sometimes narrowed and poorly defined, more commonly it is entirely absent. In this case the fibers of the internal oblique and transversalis pass directly inward toward the edge of the rectus without forming any tendinous union. The lower portion of the muscles as they pass inward will be often found much thinner than normal, and there may even be spaces between some muscle bundles exposing the transversalis fascia beneath.

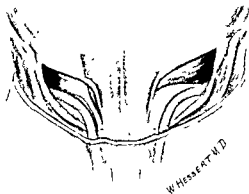
Thus there is formed a triangle whose apex is at the internal ring, the sides being formed by the internal oblique and transversalis muscles and Poupart's ligament respectively, and the base by the edge of the rectus. The floor of the triangle is formed by the transversalis fascia. This area is a very weak spot in the abdominal wall, for it is covered, and but partially so, by the fascia of the external oblique. I am inclined to the opinion that in cases where the tendon is deficient there will be found other evidences of maldevelopment, such as an atrophic condition of the fascia of the external oblique. This structure is sometimes very thin, almost transparent, and in the region of the external ring the fibers split up and separate so as to form an abnormally large opening.

If the conjoined tendon is absent, to what extent might this predispose to direct or indirect hernia?

I fully endorse Coley's statement when he says, "At present we are beginning to appreciate the fact that the great predisposing cause in all inguinal and practically the majority of femoral hernias is a congenital or preformed sac, and on the basis of this, the first and essential principle of a radical cure must be the thorough removal of such a sac." Writers differ somewhat in their description of what they consider a predisposition to inguinal hernia. A potential hernial sac of congenital origin is always a predisposition, but cannot be detected clinically.

My conception of a "predisposition," which the Germans call "weiche Leiste" or "Bruchanlage," is as follows. Clinically the external ring will be found very large, and the canal will admit the finger for a considerable distance. There is felt a distinct impulse on coughing or straining, and by sweeping the examining finger up and down with its palmar surface turned towards the median line, the absence of the conjoined tendon can readily be determined, and in its stead the blunt edge of the rectus is felt.

I deem it justifiable to operate both sides in patients who present a fully developed hernia on one side and a "Bruchanlage" or weak groin on



The illustration shows the inguinal canals exposed by splitting the fibers of the external oblique fascia and retracting the flaps. The right side presents the condition normally found, namely, a well defined conjoined tendon attached to the crest of the pubes. On the left the muscle fibers of the internal oblique and transversalis are seen to pass directly inward to be inserted high up on the rectus and no conjoined tendon is formed. This disposition of the muscles creates a triangular space whose base is the rectus and whose sides are formed by the internal oblique and transversalis and Poupart's ligament, the floor of this space is formed by the transversalis fascia.

the other. Where this had not been done, I have had patients come back after several years with a real hernia on the other side, proving that the diagnosis "predisposition" was well founded.

What is the anatomic structure of the parts when we operate these so-called cases of "predisposition?"

The external oblique fascia is thin with separated fibers and a very large external ring. On splitting up the fascia and exposing the inguinal canal, the absence of conjoined tendon is verified. The fibers of the internal oblique and transversalis muscles are inserted high up on the rectus, forming a wide "inguinal interspace." The muscles themselves are likely to be weak and attenuated. In addition to this there will occasionally be found a remnant of the unobliterated tunica vaginalis in the shape of a potential sac. Lastly we may find a sac, congenital or acquired, admitting bowel or omentum, showing that the supposed predisposition was a real hernia after all. It is freely admitted that a person presenting what would clinically be called a predisposition can go through life without ever acquiring a hernia, just as a man may die in old age, the possessor of a congenital potential hernial sac which never developed into a hernia.

There can be no doubt that the development of a direct hernia is favored in those cases where the conjoined tendon is absent. The triangular area before mentioned, supported only by the transversalis fascia and partly by the aponeurosis of the external oblique, is a very weak spot, presenting conditions favorable for the formation of a hernia.

Is the recognition of this anomaly of absent conjoined tendon of any practical importance?

I think it is a practical question in its bearing on our operative technique. Our choice of operation should be determined by the anatomic findings. We have all seen cases in which it would have been impossible to perform a typical Bassini operation. Owing to the absence of conjoined tendon and the high insertion of the muscles into the rectus, the former could not be brought down to Poupart's ligament without creating too much tension. Either the suture would tear through the muscle at once, or necrosis would occur later. Our attention has been called to the necessity of making the closure of the canal at its pubic end especially firm. Any weakness there will predispose to the recurrence of the hernia.

The technique which is best adapted to meet the requirements of these cases is the imbrication operation of Andrews. By bringing down to Poupart's ligament the edge of the fascia of the

external oblique and as much of the muscle as possible, a very firm covering for this weak area is secured, which is further fortified by the overlapping of the lower flap of fascia. In cases where the triangle is especially large or the external oblique aponeurosis is particularly thin, the Bloodgood technique will be found of service. By incising the edge of the rectus sheath, the muscle fibers are exposed and a portion of the muscle can be brought down and sutured to Poupart's ligament, thus supplanting the conjoined tendon which is absent. The operation can then be completed after the Andrews method.

#### CONCLUSIONS

1. The conjoined tendon is deficient or absent more often than has been generally observed.

2. This anomaly supplies an important predisposing factor in the development of direct hernias, and probably plays a certain rôle, though a minor one, in the etiology of oblique hernias.

3. The presence of this defect precludes the performance of the typical Bassini operation, except possibly in children.

4. The Andrews imbrication operation best fulfills the indications, regardless as to whether the tendon is present or absent. The Bloodgood transposition of the rectus will be found useful in certain cases.

## PRELIMINARY REPORT UPON THE USE OF INDIGOCARMINE INTRAVENOUSLY AS A TEST OF THE RENAL FUNCTION

By HENRY DAWSON FURNESS, M. D., NEW YORK CITY

THERE is no doubt as to the value of indigocarmine in estimating renal function. In my hands its chief use has been in determining the relative sufficiency of the kidneys after making a total estimate with phenolsulphonethalein. The great drawback has been the pain attendant upon the intramuscular injection of the 20 cc. of the 0.4 per cent solution, and even when we prevented this by the previous use of a local anæsthetic, there would be soreness and lameness of the muscles into which the solution was placed. Another objection is the variable time of appearance of the drug in the urine, consequent upon the variable time of its absorption.

To obviate the above difficulties, I recently began the use of the drug intravenously in a strength of 0.3 per cent and in amounts varying

from 5 to 10 cc. I have seen no difference in the time of appearance whether I used 5 or 10 cc. The beginning of elimination has been noted by observing the ureteral orifices through the cystoscope, and this has ranged from two to six minutes, with an average of three and a half. While I have as yet made no estimate of the amount eliminated in a given time, I have noted that the larger part is excreted in the first fifteen or twenty minutes, as after this time the color of the drug has almost entirely disappeared.

No local pain nor systemic disturbance has been noted.

One of the cases in which we have used the indigocarmine both intramuscularly and intravenously, and have also a phenolsulphonethalein estimate, is of interest. 20 cc. 0.4 per cent sol indigocarmine intramuscularly, appearance

19 min., 6 cc. 0.3 per cent sol indigocarmine intravenously, appearance  $2\frac{1}{2}$  min.; .06 gr. phenol-sulphonephthalein intravenously, in first 15 minutes 60 per cent

Had I depended upon the first test, I would have been led to believe there was some degree of renal insufficiency.

More cases will be studied, taking into consideration the amount of the drug needed for best results, the time of appearance, the percentage of elimination in a given time, and the dura-

tion of excretion. Using the same patients a comparison will be made with tests with phenol-sulphonephthalein

While the number of cases in which I have used this is not yet large, I consider the intravenous method of administration preferable to the intramuscular method in being less objectionable to the patient, and in giving more satisfactory and more uniform results by eliminating the factor of a variable time of absorption from the muscles

## VASOSTOMY-RADIOGRAPHY OF THE SEMINAL DUCTS<sup>1</sup>

By WILLIAM T. BELFIELD, M. D., CHICAGO

A GENERATION ago pus tubes in the female were virtually unrecognized, discharges from the uterus were assumed to originate in that organ and were treated accordingly. To-day pus tubes (seminal vesicle and vas) in the male are still generally unrecognized, chronic purulent discharges from the urethra are assumed to originate in that canal and are treated accordingly.

Several years ago I devised and described<sup>2</sup> the irrigation of vas and vesicle through an incision in the scrotal vas (vasostomy) whereby the entire genital duct, from epididymis to urethra, can be medicated with any suitable solution. Experience with this procedure has shown (1) that many cases of gleet, incurable through treatment of the urethra (because the discharge proceeds from the vesicles) can be thus cured, (2) that vas and vesicle may discharge their contents into the prostatic urethra not merely by ejaculation but also by unperceived peristaltic contraction—a function which explains some cases of mysterious pyuria, hæmaturia, phosphaturia, and transient albuminuria without disease of kidneys, bladder or urethra, that, in fact, the bladder may be a reservoir for the seminal as well as urinary ducts, (3) that toxæmia may proceed from chronic infection of the seminal vesicle by the colon bacillus as well as by the gonococcus, (4) that obstructions to the passage of spermatozoa from testis to urethra, causing sterility, are frequent in the vas and ejaculatory duct

More recently I have utilized vasostomy as a means of radiographing vas and vesicle, which are thus filled with a collargol solution. These



Vasa vesicles and ejaculatory ducts filled with 10 per cent collargol solution, stiletted catheter in right ureter. Radiogram by Mr. Ball, Presbyterian Hospital, Chicago (Gonococcus infection of vesicles)

radiograms reveal, among other items: (1) the occasional transformation of the infected vesicle into a pus sac, or pyovesiculosis, (2) the possible obstruction of the ureter, with consequent kidney symptoms, by an infected vesicle—a condition discovered through operation by Morgan, and by Young<sup>4</sup>

<sup>2</sup>Ann Surg Phila. 1902 p 328

<sup>4</sup>Ann Surg Phila. 1903 p 689

<sup>1</sup>Read before the American Association of Genito-Urinary Surgeons May 6, 1913

<sup>3</sup>J Am M Ass April 22 1905 and Surg Gynec and Obst Nov 1906

## A CASE OF COMPLETE ANTERIOR DISLOCATION OF BOTH BONES OF THE FOREARM AT THE ELBOW

BY RANDOLPH WINSLOW, M. D., LL. D., BALTIMORE

Professor of Surgery in the University of Maryland

A BOY, aged 9 years, was carrying a bucket filled with water along a path, when he tripped on a stick and fell on his right shoulder in soft earth, and on his right elbow on the beaten path. He was brought to University Hospital after the lapse of three days. When seen by me there was much swelling and brawniness of both arm and forearm. A small movable piece of bone or cartilage could be felt back of the elbow joint, the epicondyle could be palpated and a sharp edge of bone could be distinguished in front of the joint. The right forearm was  $13\frac{1}{2}$  inches in length and the left 13 inches. The forearm was semiflexed and directed toward the inner side, and it was somewhat movable under anesthesia. The skiagraph showed both bones of the forearm to be entirely in front of the humerus, and a slight shiver of bone apparently torn from the back part of the olecranon process. The lower humeral epiphysis also appeared to be partially separated from the shaft. Reduction was effected, under ether anesthesia, by placing the forearm in acute flexion and pushing strongly downward. The bones returned to their natural position and the movements of the joint were easily executed. The X ray showed the reduction to be complete and the separated piece of bone to be in normal contact with the olecranon.

Though my experience with dislocations at the elbow has not been extensive, it has been my

fortune to meet with two varieties of great rarity:

1. A case of complete outward dislocation of both radius and ulna, reported in the *Annals of Surgery* in May, 1900, of which, according to Stimson, about 25 cases have been recorded.

2. The case of complete anterior dislocation related above. This is also a very rare condition and, according to Stimson, "The number has not yet reached twenty-five, even including seven cases in which the olecranon was broken off and remained in place."

Anterior dislocations usually occur in the young, and they are frequently compound. They are often associated with fracture of the olecranon process, but such cases should be excluded from this category, as the olecranon fragment remains posteriorly and only the broken anterior portion is displaced forward. This dislocation occurs in an incomplete form when the tip of the olecranon remains in contact with the under surface of the humerus. It is said to be complete when both bones of the forearm lie entirely in front of the lower articular surface of the humerus. Of necessity there must be extensive laceration of the lateral ligaments of the joint, and probably the triceps tendon is torn away from the bone. There is frequently a deviation laterally of the bones of the forearm. In the case herewith reported the forearm was directed towards the inner side.

The mechanism of the production of this



Fig. 1. Complete anterior dislocation of both bones of the forearm at the elbow before reduction.

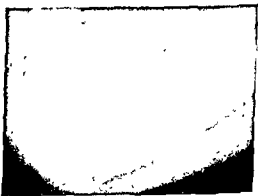


Fig. 2. After reduction.

dislocation is not well understood. Probably most cases are due to a blow or fall upon the acutely flexed elbow, but some are undoubtedly the result of a fall upon the palm of the hand. In at least one case the injury was caused by traction on the extended forearm.

Of the cases reported, one came to autopsy, three were subjected to amputation, and several, being compound, were open to inspection. Doubtless the skiagraph will reveal a larger proportion of these dislocations than has hitherto been suspected.

The symptoms ought to be quite distinctive, but as swelling occurs promptly the bony points are soon obscured and it may be very difficult to determine the nature of the injury without an X-ray examination. The limb is usually semi-flexed and the forearm somewhat lengthened,

the olecranon is seen to be absent from its usual position and the lower end of the humerus can be palpated. The olecranon process can often be felt in front of the humerus, and the head of the radius may also be palpated at times. The course of the uncomplicated cases appears to have been fairly satisfactory, but the compound dislocations generally suppurated and were either amputated or resulted in impaired function.

Reduction can usually be effected by flexing the elbow and pushing the forearm downward and backward. In some cases reduction has been accomplished by passing a band around the upper end of the forearm and pulling downward while pressure is made on the humerus to force it forward. Reduction has also been effected by bending the flexed elbow around the knee of the operator of the arm of an assistant.

## PERIRENAL HÆMATOMA<sup>1</sup>

By JOHN SPEESE, M. D., PHILADELPHIA

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**A**LTHOUGH perirenal hæmorrhage was accurately described by Wunderlich in 1856, the affection remained unknown until 1907, when Doll's contribution to the subject was made. Since then numerous cases have been recorded and the nature of the affection well established. The history of an additional case may be of value, especially as the subject has been limited largely to French and German reports. The operation was performed by Dr. Edward Martin, to whom I am indebted for permission to report the case.

A G., aged 43, fireman, married, father of four children, who are living and well. Has had gonorrhœa, but denies lues. Was entirely well until two days before admission to the hospital (March 3, 1912), when after exposure to extremes of cold and heat, he developed a chill which was followed by profuse sweating. He denies having sustained any injury in the kidney region. He retired at night complaining of malaise, and the following morning of aching in the arms and legs. Urine contained albumin, a few hyaline casts, and a moderate amount of red and white blood-cells. Blood hæmoglobin 75 per cent, red blood cells 3,050,000, white blood cells 16,200. His condition remained about the same until March 10, when he complained of pain which radiated from the right hypochondrium to the lumbar region, where a tender mass was found on palpation.

March 11, 1912, patient still complained of pain in right kidney region, where a decided fullness was present, extend-

ing 3 cm. below the costal border, painful on pressure and movable on bimanual palpation. Patient was very much prostrated; pallor was marked, pulse rapid, temperature 101°. Urine 1023, acid, albumin abundant, granular casts, few leucocytes, no red blood cells, leucocytic count 16,400.

March 14, 1912, examination of feces for blood negative. White blood cells 25,700. Chromo-ureteroscopy and ureteral catheterization by Dr. B. A. Thomas was as follows: Bladder was slightly more capacious than normal and showed trabeculous hypertrophy. The prostate was slightly enlarged and the ureteral orifices normal. Catheter No. 6 passed 15 cm. up both ureters, and urine, saffron yellow in color, was collected for physical, chemical, and bacteriological examination. The elimination was about twice as much from the left as from the right side, both sides eliminating less than normally. Indigocarmine left—13 min. (light blue), right—trace in 20 min.

Examination of catheterized specimen of urine from ureters: Right ureter—amount 1 cc., amber, cloudy sediment, no casts, a few red blood cells, no white blood cells, a few round granular epithelial cells, no crystals, no tubercle bacilli. Left ureter—amount 5 cc., amber, cloudy sediment, no red blood cells, an occasional white blood cell, many small round epithelial cells, no crystals, no tubercle bacilli.

March 17, urine showed flocculent sediment, specific gravity 1020, acid, no albumin or sugar. No casts, no red blood cells, few white blood cells, a few squamous epithelial cells, no crystals. Blood hæmoglobin 65 per cent, red blood cells 3,810,000, white blood cells 23,500.

March 19, as there was some doubt about the diagnosis, an exploratory abdominal operation was made and a retroperitoneal mass apparently connected with the right kidney was revealed. The abdominal wound was closed, and the

<sup>1</sup>Read before the Academy of Surgery of Philadelphia November 4, 1912. From the Laboratory of Surgical Pathology, University of Pennsylvania.





kidney exposed by lumbar incision. The entire fatty capsule was enveloped in a mass of blood clot and a large amount of fresh blood escaped when the tissues were divided. The fibrous capsule was completely stripped from the kidney and was adherent to the fatty capsule, which was extravasated with blood. The outer surface of the kidney contained an irregular tear measuring about 3 cm. in length and filled with coagulated blood. The process was regarded as probably malignant and the kidney was extirpated with its greatly thickened capsule. The blood clots were removed from the surrounding tissues and the wound closed with drainage. (See illustration.)

The patient developed an infection in the perirenal space which did not completely subside for several weeks, the sinuses closed nine weeks after the operation. The urine at the time of his discharge from the hospital was normal in amount but contained a slight amount of albumin and a few casts.

**Pathological examination** The specimen consisted of a kidney and fatty capsule, the organ measuring 13 cm. in length by 8 cm. in breadth. It was intensely hemorrhagic and showed the presence of many blood clots on the surface. At one point, about the center of the organ, was an oval rupture measuring 4 x 3 cm., extending from the dorsum almost to the hilus, containing a mass of friable tissue and blood clot. The fatty cap-

sule measured about 20 cm. in length by 13 cm. in breadth, was enormously thickened and was filled with hemorrhagic extravasation. The inner lining of the fatty capsule was smooth and evidently represented the fibrous capsule, which had been separated from the kidney. Several large rents were present, through which soft blood clots projected. Section through the kidney in the region of the above mentioned area of rupture showed grossly an apparent erosion of the kidney tissue by the blood mass.

Microscopically, the kidney tissue itself was the seat of cloudy swelling, obliteration of many glomeruli, an excess of connective tissue and thickening of the blood-vessels. Toward the periphery of the kidney and directly in contact with the blood clot, beginning organization of the latter was present. Small areas of necrosis and a few clumps of leucocytes were seen in this region, but no distinct inflammatory reaction was noted. The mass of tissue surrounding the kidney, which has been described grossly as the fatty capsule, consisted chiefly of blood clot and fatty tissue. Throughout the blood clot were numerous newly formed capillaries. The process of organization appeared to be somewhat further advanced here than in the clot in the kidney itself.

On the inner surface of the fatty capsule a delicate fibrous stroma representing the detached fibrous capsule was present. The blood-vessels contained within it were normal in appearance, there was no evidence of pathologic change in the tissue.

Sections through the renal vessels and ureter showed a normal appearance.

The process was regarded as a perirenal hemorrhage, secondary to chronic interstitial nephritis, the only pathologic feature demonstrated. The minute areas of necrosis were produced by pressure of the clot rather than by infection, because the inflammatory nature of an infectious process was entirely wanting.

Perirenal hemorrhage may be traumatic in origin and follow contusions or other injuries in the kidney region, or result from tuberculosis, tumors, hamophilia, calculus, or septic processes in the cortex of the kidney. The explanation of hamatomata of traumatic, hamophilic, or neoplastic origin is easily made. In those cases of spontaneous hemorrhage with the capsule intact, or in which the hemorrhage appears between the kidney and its fibrous capsule, the explanation must be based upon some underlying pathologic process, when traumatism and other factors can be excluded from the etiology.

Rupture of a renal blood-vessel has been sug-

gested as a possible cause of the hæmatoma, but this seems unlikely, as a bleeding point has not been discovered at operation, and search for a ruptured artery or vein in the operative or post-mortem specimens has been unsuccessful. The histologic examination of the kidney in the operative cases, and the urinary findings in other instances, show that chronic nephritis is constantly present in spontaneous perirenal hæmorrhage.

Inflammation of the kidney parenchyma gradually extends to the fibrous capsule which becomes thickened. The exact manner in which the hæmorrhage develops is not clear, whether traumatism so mild as to be overlooked may rupture a small arteriosclerotic vessel and give rise to the initial bleeding, or whether it is a diapedesis incidental to vasomotor disturbances, is a question. As the hæmatoma enlarges, the capsule is gradually stripped from the kidney, rupturing the small vessels between the organ and the capsule, and thus promoting fresh hæmorrhage. If the pressure exerted by the clot is sufficiently great the kidney may be eroded, rupture of the capsule follows, the blood infiltrates the fatty capsule and gradually extends to the retroperitoneal tissues. When a spontaneous hæmorrhage occurs in the fatty tissues about the kidney and the fibrous capsule is intact, the hæmorrhage is believed to occur from diseased vessels in either capsule, for both undergo thickening and degeneration in chronic nephritis, or the blood is derived from a source other than the kidney.

While chronic inflammation of the kidney plays an important predisposing rôle in the development of perirenal effusions, as it does in essential hæmaturia, the cases in which ulceration or rupture of the cortex occurred point conclusively to the kidney as the source of the hæmorrhage. This was noted in Doll's second case, in which a rent in the capsule and cortex was found, and in the author's case, in which even a larger rupture was present.

Coenen, from his observations, concludes that the kidney is the source of the hæmorrhage, for the following reasons: (1) the anatomical position of the effusion, (2) the frequent occurrence of tears or ruptures of the fibrous capsule, (3) infarction of the fibrous capsule in some cases, (4) the occurrence of perirenal hæmorrhage in tuberculosis and tumors of the kidney.

Ricker, on the other hand, believes the hæmorrhage is derived by diapedesis from the vessels of the fibrous capsule, brought about by insufficient stimulation of the vasoconstrictor nerves. As his case had an associated lesion of the central

nervous system to account for the vascular disturbance, it is impossible to apply his theory to other instances in which such lesions were absent.

All hæmorrhages into the retroperitoneal tissues do not arise from the kidney or the perirenal tissues. Koch observed a case presenting typical symptoms of a perirenal hæmatoma, the hæmorrhage being derived from the adrenal gland, which was both hæmorrhagic and necrotic. It is of interest to note that the same symptoms were produced by hæmorrhage into the quadratus lumborum muscle, as reported by Coenen, and by rupture of the epigastric artery into the sheath of the rectus muscle (Michaux).

Perirenal hæmorrhage, therefore, is due to many factors, it results from diseases of the kidney (tuberculosis, tumors), hæmophilia, adrenal hæmorrhage, and in certain cases is spontaneous, apparently being predisposed to by chronic nephritis.

The development of hæmatomata of perirenal origin is accompanied by symptoms which are so characteristic that the diagnosis should be made without difficulty. The three chief symptoms emphasized by Lenk are sudden and severe pain in the kidney region, the indications of internal hæmorrhage, and the development of a retroperitoneal tumor.

Pain is the first symptom noted, and is frequently followed by nausea and vomiting. In the majority of cases the pain occurs at intervals of days or weeks, each attack being the indication of a fresh hæmorrhage, in a few instances the pain has been constant in character. The pain radiates from the kidney toward the lumbar or sacral regions, the back, hip, or the shoulder. Generally there is a tendency for the pain to localize itself in the region of the affected kidney, but sometimes a diffuse tenderness may persist. The pain is due to pressure on the kidney capsule, which contains a rich nerve supply, and is explained in the same manner as is the pain in renal hæmaturia accompanied by colic, in which there is no demonstrable obstruction to the ureter by a clot or other foreign body. In these cases the sudden increase in intrarenal pressure incident to acute congestion and swelling of the kidney, and the subsequent distention of the fibrous capsule with pressure on its nerves, is held responsible for the colic-like pains.

The symptoms of internal hæmorrhage, next to pain, are of the most importance in the diagnosis of perirenal hæmorrhage. The bleeding is frequently accompanied by shock, which may appear during the initial attack of pain or later. The pallor and shock are due to loss of blood and to

reflex nerve disturbance. After several attacks, each accompanied by a fresh hæmorrhage, a secondary anæmia develops.

The situation of the hæmatoma is a matter of extreme interest and importance in explaining its origin. In 5 of the 21 cases the hæmorrhage occurred between the kidney and its capsule, so that the latter was detached and became adherent to the fatty capsule. In 6 of the remaining cases the capsule was ruptured, and the coagulum surrounded the kidney and infiltrated the fatty capsule and retroperitoneal tissues. In the remaining cases, in which the hæmorrhage was derived from the kidney, the capsule was reported as intact, although the seat of chronic inflammatory changes.

The hæmatoma occurs in the form of a blood cyst, the walls of which are formed by organization of the clot and by the surrounding tissues. The contents may be fluid to a large extent, or the blood may be present in layers due to the organization of recurring hæmorrhages. In some cases the blood remains in a fluid state a long time before organization begins. Absorption of the coloring matter may then occur, and finally the coagulum is converted into a clear collection, and its hæmorrhagic character only recognized by minute remnants of clot in the wall (Koch). It is likely that some of the so-called perirenal cysts originated in this manner.

The hæmatoma is usually large, extending from the diaphragm to the pelvis and to the midline anteriorly, and varies from the size of a child's head to tumors several times this size. The contents have been estimated at 15 liters (Hildebrand), two pints (Frazier), and by others have been described as large masses of fluid and coagulated blood. As the hæmatoma enlarges, the abdominal resistance and tenderness increase, so that the exact size and nature of the tumor is often difficult to determine. The hæmatoma usually appears soon after the onset of pain, and attention is directed to it by the localization of the pain in the kidney region. Occasionally the mass diminishes in size between the attacks, the blood either undergoing partial absorption or is diffused through the retroperitoneal tissues and the viscera, or may gain access to the abdominal cavity. Suffusion of the mesentery and the intestinal wall produces an appearance which resembles incarceration or strangulation of the intestine. As the extravasation of blood continues, the more superficial parts become invaded, and discoloration of the skin in the lumbar, scrotal, and iliac regions occurs, a symptom of much diagnostic worth.

The body temperature immediately after a retroperitoneal hæmorrhage becomes subnormal as a result of loss of blood and shock. The secondary elevation of the temperature is quite characteristic, according to Doll, and is due to the absorption of fibrin ferment. Late infections may arise from bacteria which, passing through the distended intestinal walls, cause abscess formation or even peritonitis.

The intestinal distention which is generally present is due to the rapidly developing hæmatoma pressing on the intestines so suddenly that they do not have time to accommodate themselves to the change, fermentation of the contents is thus caused, and meteorism results. In addition to the pressure of the clot, Lenk describes a reflex irritation of the splanchnic nerves, and in this manner he explains the meteorism which follows operations for hæmorrhoids, umbilical hernia, etc. Distention occurs in the hæmorrhages which infiltrate the retroperitoneal tissues and finally the mesentery itself. Then the function and possibly to some extent the nutrition of the bowel may be affected according to de Quervain, who has observed such distention in extraperitoneal rupture of the kidney. The suffusion of the mesentery and even the intestinal walls permits some of the blood to pass into the lumen of the intestine and appear in the stools. This symptom has been noted by Lawen, who ascribes considerable value to it as a diagnostic aid.

Jaundice has occurred in a few cases, is hæmatogenous in origin, and has led to some difficulty in the diagnosis, as it has suggested gall-bladder disease.

The examination of the urine was normal in only four instances, in seven there was hæmaturia, and in the remaining, some form of chronic nephritis was usually present. In four of the cases hæmaturia was due to uror formation, tuberculosis, or hæmophilia (Tuffier, Cathelin, Coenen). In Lawen's first case a toxic nephritis was present to account for the mild hæmaturia.

The urine removed by catheterization of the ureters in three instances has shown functional insufficiency of the affected kidney. In Lenk's second case indigocarmine was secreted in ten minutes from the left kidney, and a slight amount in one hour from the right. There was no response to the phloridzin test from this side. Diminution in functional activity has been observed in the cases reported by Pick and Speese; in both, the kidney was found to be surrounded by a hæmatoma, the organization of which caused compression of the kidney and contributed to its functional incapacity. The subsequent micro-

scopic examination (Lenk, Speese) of two of the organs demonstrated a chronic nephritis of insufficient degree in itself to cause the functional changes noted.

A review of the reported cases shows that 16 occurred in males and 5 in females. The relative infrequency in the female sex may be due to mode of life, the greater movability of the kidney, and the natural protection which the shape of the female pelvis affords. The majority of the cases are seen in adult life, in males, and at a much younger period than in females, the average being 29 years for the former, and 39 for the latter. The youngest case occurred in a male 18 years of age, and the oldest in a man aged 60. There is no site of predilection, for in the published reports of 17 cases, 8 occurred on the left and 9 on the right side.

The course of the disease is usually rapid, immediate operation being demanded for the severe nature of the pain, or death results from anæmia, infection of the clot, or pulmonary complications induced by pressure upon the diaphragm. The chronic nephritis so frequently associated with the disease may cause uræmia, from which several patients have died. The disease in rare instances pursues a more chronic course and produces symptoms and intermittent attacks of pain lasting several months or even years (Lenk, Koch, Coenen).

The treatment of perirenal hæmatoma by measures other than surgical has been uniformly unsuccessful. There have been ten cures and six deaths from operations, one case died before operation was begun, and all four died who were treated by non-operative methods.

The operations performed vary from simple exposure of the kidney and drainage after removal of the clots to nephrectomy. In those cases in which the capsule is intact, drainage seems to be sufficient. When the capsule is torn and the kidney substance diseased, especially when functional tests have shown an organ which is not secreting, several surgeons have performed nephrectomy. Whether such organs can be saved by more conservative operations, and whether their function would return after tension is relieved, depends upon the type of disease and the amount of kidney tissue involved in the process.

The percentage of deaths (52) indicates that the prognosis is unfavorable, but we must take into consideration the fact that we are dealing with a disease to which little attention has been directed. As our knowledge of the nature of the affection increases, earlier operations will be

performed before serious damage to the kidney or infection of the perirenal space is likely to arise.

#### CONCLUSIONS

1. Perirenal hæmorrhage is caused by tuberculosis, abscess or tumors of the kidney, necrosis of the adrenal gland, traumatism, and occasionally arises in hæmophilia. The spontaneous form is probably due to chronic nephritis, the only pathologic lesion which has been demonstrated.

2. The characteristic symptoms of the disease are sudden pain, the signs of internal hæmorrhage, and the formation of a retroperitoneal tumor.

3. A moderate degree of hæmaturia is present in one third of the cases. Functional tests show diminution in the secretory activity of the kidney.

4. The affection is most commonly mistaken for intestinal obstruction or paranephritic abscess.

5. The disease pursues a rapid course if unrelied, death resulting from hæmorrhage, infection, or pulmonary complications.

6. Medical treatment has been uniformly unsuccessful.

7. Ten of the 16 cases operated upon have recovered (62 per cent). The mortality of the 21 cases treated by both surgical and medical measures is 52.5 per cent.

CASE 1 (*Ibid* 7) Female, aged 19. Duration 3 weeks. Symptoms and findings: sudden pain left side abdomen, pallor, tumor, sac contained 15 coagulated blood. Cause: ulceration of aneurysm of renal artery (?). Diagnosis: hæmorrhage from new growth. Urine: normal. Pathological diagnosis: normal. Result: sac drained, cured.

CASE 2 (*Ibid* 11) Male, aged 40. Duration 1 day. Symptoms and findings: pain and tumor formation in ilio-cæcal region, pallor, large tumor connected with kidney. Cause: sarcoma. Diagnosis: appendicitis. Urine: hæmaturia. Pathological diagnosis: ulcerating round cell sarcoma. Result: nephrectomy, death following day from hæmorrhage.

CASE 3 (*Ibid* 15) Symptoms and findings: swelling in kidney region regarded as abscess, hæmatoma from cancer of kidney. Cause: carcinoma of kidney. Diagnosis: paranephritic abscess. Result: (1) removal of clots, (2) secondary nephrectomy, cured.

CASE 4 (*Ibid* 13) Old man. Symptoms and findings: inflammatory tumor in lumbar region, perirenal hæmatoma. Cause: interstitial nephritis. Diagnosis: abscess. Urine: hæmaturia. Pathological diagnosis: interstitial nephritis. Result: drainage, death.

CASE 5 (*Ibid* 12) Female, aged 25. Duration 6 months. Symptoms and findings: hæmaturia, operation revealed sac containing 400 gm. blood between kidney and fibrous capsule. Cause: tuberculosis. Urine: hæmaturia. Pathological diagnosis: tuberculous kidney. Result: nephrectomy, cured.

CASE 6 (*Ibid* 2) Male, aged 60. Duration 5 days. Symptoms and findings: severe attacks of pain in left kidney region, tumor formation, metrorrhœsis, suffusion in skin of hip and scrotum. Cause: arteriosclerosis. Urine:

chronic nephritis. Pathological diagnosis: perirenal hematoma. Result: no operation, death.

CASE 7 (*Ibid* 2). Male, aged 41. Duration: 6 days. Symptoms and findings: intermittent attacks of pain in left side; tumor in two days, metrorrhagia, perirenal hematoma. Cause: arteriosclerosis. Diagnosis: perirenal hematoma. Urine: albuminuria. Pathological diagnosis: tear in kidney cortex 1 cm long, necrosis on microscopic examination. Result: no operation, death.

CASE 8 (*Ibid* 16). Male, aged 50. Duration: 12 days. Symptoms and findings: intermittent attacks of pain in right side of abdomen, distention, collapse, dullness over kidney area, fever, infiltration of blood in fatty capsule. Cause: nephritis. Diagnosis: paranephritic and appendiceal abscess, hydronephrosis. Urine: albumin and casts. Pathological diagnosis: abscess of kidney. Result: nephrectomy, sepsis, death.

CASE 9 (*Ibid* 8). Male, aged 27. Duration: 6 weeks. Symptoms and findings: intermittent attacks of pain in right side of abdomen, which was rigid and tender, suffusion of fatty capsule, a pint of blood removed. Cause: tuberculosis (?). Diagnosis: cholecystitis. Urine: albuminuria. Pathological diagnosis: normal kidney. Result: drainage, cured.

CASE 10 (*Ibid* 5). Female, aged 20. Duration: 6 days. Symptoms and findings: cramp-like pains in right side of abdomen, marked pallor, temperature 39°, hematoma size of child's head, containing fetid blood clots. Cause: parenchymatous nephritis. Diagnosis: appendiceal abscess. Urine: normal. Pathological diagnosis: nephritis. Result: drainage, death on fourth day.

CASE 11 (*Ibid* 3). Female, aged 28. Duration: 255 years. Symptoms and findings: attacks of pain during several years, tumor in right costal region, fever, vomiting, jaundice, organization of hematoma. Cause: hydronephrosis, interstitial nephritis. Diagnosis: hydronephrosis. Urine: polyuria. Pathological diagnosis: chronic nephritis. Result: nephrectomy, cured.

CASE 12 (*Ibid* 17). Male, aged 31. Duration: 11 months. Symptoms and findings: renal colic and hematuria, tumor in left lumbar region followed by one on right, the latter contained blood, the older one serous fluid with evidences of clot. Cause: interstitial nephritis. Urine: albumin, blood. Pathological diagnosis: interstitial nephritis. Result: no operation, death.

CASE 13 (*Ibid* 14). Female, aged 55. Duration: 3 days. Symptoms and findings: sudden pain right side, shock, fever, jaundice, tumor in gall bladder region, perirenal hematoma extending to mesocolon. Cause: chronic nephritis. Diagnosis: cholecystitis. Urine: albumin and casts. Pathological diagnosis: normal. Result: incision, drainage, cured.

CASE 14 (*Ibid* 3). Male, aged 53. Duration: 4 months. Symptoms and findings: sudden pain centralizing in left kidney region, tumor in left lumbar region, large hematoma thick walled sac. Cause: hemorrhoids, interstitial nephritis. Diagnosis: tumor kidney. Urine: blood. Pathological diagnosis: floating kidney, interstitial nephritis. Result: nephrectomy, post-operative hemorrhage, death.

CASE 15 (*Ibid* 10). Male, aged 49. Symptoms and findings: severe pains in left kidney region, unconsciousness, distention of abdomen, tumor in region of left kidney, hematoma between kidney and its capsule and in quadratus lumborum. Cause: pyelonephritis. Urine: albumin, casts. Pathological diagnosis: renal calculus, pyelonephritis. Result: death at beginning of operation.

CASE 16 (*Ibid* 16). Male, aged 18. Duration: 12 days. Symptoms and findings: intermittent attacks of pain, nausea, vomiting, fever, blood in stools, distention,

hemorrhage between left kidney and fibrous capsule. Cause: toxic nephritis. Diagnosis: paranephritic abscess. Urine: albumin, casts, blood. Pathological diagnosis: toxic nephritis. Result: drainage of hematoma, cured.

CASE 17. Male, aged 40. Symptoms and findings: fall, striking buttock; had spastic epinal paralysis, autopsy revealed large hematoma separating fibrous capsule from left kidney. Cause: traumatism. Result: no operation, death.

CASE 18 (*Ibid* 17). Male, aged 29. Duration: 1 day. Symptoms and findings: severe pain in left side of abdomen, swelling on same side, pallor, shock, slight fever, retroperitoneal tumor containing fragments of the adrenal gland, kidney and capsule normal. Cause: necrosis and hemorrhage of adrenal. Diagnosis: ileus. Urine: normal. Pathological diagnosis: normal. Result: operation, death in 22 hours.

CASE 19 (*Ibid* 18). Male, aged 28. Duration: 1 day. Symptoms and findings: sudden pain in right chest and abdomen and symptoms of peritonitis, tumor in right lumbar region, perirenal hemorrhage, kidney intact. Cause: chronic nephritis. Diagnosis: peritonitis. Urine: chronic nephritis, hematuria. Pathological diagnosis: kidney normal. Result: operation, drainage, cured.

CASE 20 (*Ibid* 19). Male, aged 45. Duration: 10 days. Symptoms and findings: pain in right lumbar region for one half year, sudden attack accompanied by chill and nausea, tumor, perirenal effusion discovered. Cause: abscess kidney. Diagnosis: paranephritic abscess. Urine: normal. Pathological diagnosis: section of kidney showed ulcers of cortex and medulla. Result: drainage, cured.

CASE 21 (Specie). Male, aged 43. Duration: 10 days. Symptoms and findings: sudden and acute pain in right hypochondrium followed by appearance of tumor in same region, pallor, shock followed by fever of 101°, perirenal hematoma separating fibrous capsule and infiltrating fatty capsule of kidney. Cause: chronic nephritis. Diagnosis: paranephritic abscess. Urine: albumin, casts, few red blood cells. Pathological diagnosis: chronic nephritis. Result: nephrectomy, cured.

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## A CASE OF BLOOD TRANSFUSION IN ECTOPIC PREGNANCY

By EDWARD L. CORNELL, S. B., M. D., CHICAGO

**D**IRECT blood transfusion in ectopic pregnancy is a procedure that has been used but little. In reviewing the literature of the past few years, I have been able to locate only three cases. In a private communication, Dr. A. L. Soresi reports ten additional cases which he has collected from the literature or directly from the hospital records.<sup>1</sup> In view of the wonderful changes for the better that immediately follow blood transfusion, it seems rational that this method should have more prominence in the treatment of ectopic pregnancy. Undoubtedly many lives could be saved which are now lost by infusing normal salt solution alone.

Case 471,827<sup>2</sup> (Cook County Hospital) A M., married, 22 years old, housewife, born in Hungary. Entered the hospital December 29, 1911, with the following history. Her last regular menstrual period was November 12, 1911. She missed the next one, which should have appeared December 10, 1911. Until two weeks previous to entering the hospital she had been feeling as well as usual. At that time, after a heavy washing, she found herself bleeding from the vagina. The bleeding continued, though was not profuse, until she entered the hospital. Two days prior to entering the hospital she lifted something heavy and immediately felt a sudden, sharp pain in the lower abdomen, which was localized to the left lower quadrant. It continued to be very severe for about two hours; later she vomited once or twice. The pain was severe enough to cause her to go to bed and remain there. No blood clots were passed from the vagina. The local doctor said there was no temperature. The pulse gradually became weaker and more rapid and her appetite was poor after going to bed. The bowels were constipated and moved only once in two days.

Upon entrance into the hospital she complained of being thirsty. She had been drinking water freely, but could not be satisfied. The feet and hands were cold. There was pain low down on the left side of the abdomen. It was constant, with occasional sharp, shooting pains.

Her menses had been regular, 28-day type, lasting four to five days; they began at 12 years of age. She had had two children, born normally, both living and well, had had no miscarriages.

**Examination.** The patient was very pale and evidently suffering from a great deal of abdominal pain, rather restless. Her lips and conjunctive were pale. Chest normal, heart action rapid, no murmurs. Abdomen markedly distended. Tenderness was elicited on palpation over the entire abdomen, but was more marked in the left lower quadrant. Dullness was found in the flanks which changed its position on moving the patient. There was

considerable rigidity on the left side. No definite tumor mass was palpated. On vaginal examination, there was little bleeding from the uterus. The cervix was slightly softened and lacerated and admitted the tip of the finger. The uterus was somewhat enlarged and not as firm as normal. It was slightly tender to the touch. A mass was palpated to the left of the uterus, which was very tender. It was of a boggy consistency. The cul-de-sac of Douglas was filled with fluid. The pulse was weak and thready, rate 132, temp 97.2°, resp 40.

**Operation** December 30, 1911. Temp 99.4°, pulse 142, resp 48. Ether anesthesia for 35 minutes. Incision in the median line. Ruptured ectopic pregnancy found, the left tube torn near the outer end and a free bleeding point seen in the tear. Tube clamped off and uterine incision done. Free blood and clots found in the abdomen, estimated at 1200 cc., the greater portion of which was easily removed without injury to the peritoneum. About 1600 cc. of normal salt solution was left in the abdomen. The abdominal wound was closed without drainage. Pulse 140, resp 48.

**After treatment.** The patient was placed in bed with the foot elevated about 6 inches. External heat was applied. Shortly after returning from the operating room she began to hiccup. Normal salt solution, 6 oz., per rectum was given every four hours. The pulse remained about the same, but the respirations began to climb, reaching 60. (By referring to the temperature chart the pulse, temperature and respirations will be seen more fully.)

December 31, 1911, at 4 P. M., the patient was transfused with about 750 cc. of blood taken from her husband. The Curtis method was used. The apparatus consisted of a 500 cc. round bottomed bottle with a wide neck. In the bottom of the bottle were blown two cannulae, one on either side. These cannulae were just large enough to enter the median vein of the arm. The sterilized bottle and cannulae were carefully coated with sterile paraffin.

The median veins in the donor and the recipient were dissected for about 2 inches under cocaine anesthesia. The vein in the donor was tied and cut distally. One cannula was inserted in the distal end of the vein. The vein was held closed by pressure of the finger. The recipient's vein was tied and cut proximal to the ligature. The other cannula was inserted into the proximal end of the vein. A two-way pump was then attached to the neck of the bottle by means of a long, hard rubber tube. The vacuum side of the pump was applied and about 100 cc. of blood ran into the bottle. Enough sterile olive oil was then poured in to cover the top of the blood completely. The pump was reapposed and the bottle filled. After filling the bottle, the pump was changed to a force pump and finger pressure reapplied to the donor's vein and the blood forced into the recipient's vein. The process was repeated, and about 250 cc. more blood transfused. The veins were then tied off and the skin wounds closed.

While transfusing the 500 cc. of blood, there was a noticeable change in the pulse. It became stronger, there was also a return of color to the patient's lips. Half an hour after transfusion, her pulse was reduced to 128, full and bounding in character. The respirations dropped to 40. The patient's general condition improved markedly.

From then on the patient improved rapidly, except for temperature, which was present for the first nine days, due (as we found out later) to wound infection. After releas-

<sup>1</sup> Since this report was written another case of ectopic pregnancy was transfused at the Presbyterian Hospital by Dr. Curtis and one liter of blood injected. The patient was moribund at the time of the transfusion and revived remarkably. She died three days later from complications.

<sup>2</sup> I wish to thank Dr. Gilbert Fitz-Patrick, upon whose service the case appeared for the privilege of reporting it also Dr. Arthur H. Curtis for his courtesy in performing the blood transfusion.



# THE CAUTERY IN THE RADICAL TREATMENT OF CANCER OF THE CERVIX

## A CORRECTION

BY X O WERDER, M D, PITTSBURGH

IN the original article in the March issue of SURGERY, GYNECOLOGY AND OBSTETRICS (pp. 272-280), it will be noted that there is a discrepancy between the statistical table and the accompanying text. While the text is correct, the statistical table shows somewhat different results, this being due to the fact that, through a mistake on the part of the publishers, an old table was printed which was submitted a year ago for publication, instead of the one presented with the paper as read before the Clinical Congress of Surgeons. One year elapsed between the writing of the first and second papers, and this, of course, required some revision of the table, as new cases came into the five-year period. In the meantime some cases died, and those living should have been credited with one year more than appears in the table. Instead of changing the table of results accordingly, the new cases were simply added without revising the record of the old cases.

Briefly, the changes should be as follows (cases being referred to by number corresponding to those in the table printed): Cases 26 to 39 inclusive are correct as printed. In cases recorded as living, from 1 to 25 inclusive, one year should have been added to the length of time since the operation of these patients with the three following exceptions:

CASE 18. Mrs M S, recorded as living 6 years, vesico-vaginal fistula still present, should be revised. Death after six and one half years (March, 1912) from carcinoma of the liver.

CASE 22. Mrs D P B, recorded as living five years, health poor but no evidence of recurrence; should be revised. Death after six years from carcinoma of retroperitoneal glands and spinal cord.

CASE 25. Mrs J E, recorded as living five years, had vesico-vaginal fistula, recurrence, should be revised. Death after five and one half years from recurrence.

## SUMMARY OF RESULTS

Total number of cases operated upon	78
Primary mortality—4 cases	5 1%
Cases operated upon over five years ago	39
By vaginal method	21
By combined vaginal and abdominal method	18
Surviving five-year limit—18 cases	46%
Deaths after five years from recurrence—4 cases	22%
1 after 6½ years from carcinoma of liver	
1 after 6 years, recurrence in retroperitoneal glands and spinal cord	
1 after 5 years, recurrence in lumbar glands	
1 after 5 years, site of recurrence not known	
Death from intercurrent disease after 6 years	1
Living and well at present time—13 cases.	33½%

For the article in full, see pp. 272-280 of the March, 1913, issue of SURGERY, GYNECOLOGY AND OBSTETRICS.



# TRANSACTIONS OF SOCIETIES

## CHICAGO SURGICAL SOCIETY

REGULAR MEETING HELD JANUARY 10, 1913, WITH THE PRESIDENT, DR. CHARLES DAVISON,  
IN THE CHAIR

DR. WILLIAM HESSERT read a paper on "Some Observations on the Anatomy of the Inguinal Region with Special Reference to Absence of the Conjoined Tendon" (See p. 566)

### DISCUSSION

DR. ARTHUR DEAN BEVAN: I have been very much interested in Dr. Hessert's paper. I have never seen in the cadaver a dissection in which there was not a bony insertion of the lower part of the fibers of the transversalis and internal oblique into the pubes. I have seen just what Dr. Hessert has pictured here in the diagram of the internal oblique and transversalis arching up over, and no definite aponeurosis with the conjoined tendon apparent. But when the dissection is completed there is always a tendinous insertion into the body of the pubic bone.

DR. E. WYLLIS ANDREWS: The essayist states that he always operates upon the weak ring on one side secondary to the appearance of a hernia upon the other. In this statement he voices a sentiment I have expressed repeatedly, and as time goes on I more firmly believe it. The average adult who acquires a hernia upon one side will be found to have a weak ring on the other side. The occurrence of another hernia is most likely, we have therefore been gradually led into the practice of doing what I call in my clinic a "phantom" or "humbug" herniotomy on the other side. We are duplicating and fortifying the weak walls on the other side, because time and again patients come back to us with the other side ruptured, and we find in our records that a *patulous ring* was recorded at the first operation. These patients come back to us with a hernia, and we say, as long as the operation is not attended with any risk or serious drawbacks, why not do the operation, even though occasionally one may be done unnecessarily. Referring to the drawing of the anatomy in the paper, I will point out in a little different way my mental picture of the "red muscle" (internal oblique). Just as Dr. Mayo pointed out in a recent interesting paper, there

is a pathology in the living different from dead pathology, so we must bear in mind that anatomy in the living is different from the anatomy in the cadaver. Opening the inguinal canal in any kind of hernia, oblique or direct, I have noticed, in more than 1,000 cases I have done, the conjoined tendon and "red muscle" clear down half the length of Poupart's ligament and underlying the whole length of the cord in normal canals. Beginning at the outer end and running right along forming the posterior wall is a heavy red muscular floor, and this muscle oftentimes is partly between the cord and Poupart's ligament, so that the canal is not bounded above more by ligament or behind by muscle and in front by aponeurosis, but the canal is tunneled through muscle. There is muscle below it and muscle in front of it and behind and above it. That sort of patient does not have any border or lower edge to his red muscle. We do not know which muscle that is. I have never yet been able to tell whether it is the transversalis or internal oblique. Are they not united like one muscle at their lower segments?

DR. HESSERT: They are one. You cannot differentiate them.

DR. ANDREWS: In large rings, however, we see a muscular edge, one can put a blunt instrument under it and lift it up when it has a distinct lower edge, a thing you cannot do with a normal hernia. The richer the red muscle is in quantity, the greater the bulk of it in the abdominal wall, the less there is of the white aponeurotic termination of the muscle. The average healthy man who has no predisposition to hernia would show no white tissue, as you look straight backward into the inguinal canal after you have unroofed the canal by incision.

A short time ago at the County Hospital I had absolutely that picture from here to here (indicating), with muscular edge. The fibers, it is true, as Dr. Bevan says, may become tendinous and run down to the pubes. Everybody in America recognizes that a Bassini operation is practically useless in very large rings, and there

are all sorts of plans, of which Dr. Hessert only mentioned one or two, to supplement by some adequate plastic method and even heteroplastic method this deficiency. Where Poupart's ligament is pulled up and the opposing tissues down, the muscle is under great tension. The Bassini operation becomes impractical in such cases. If one cuts the sheath of the rectus vertically he is quite able to bring a few strings of that muscle out, a picture of which is given in Kelly's "Gynecology." The method is similar to the Halsted. But some operators take the edge of the rectus intact without cutting, that is, the sheath, muscle and all, which I have never found to work. Can you do that?

DR. HESSERT: I have never found it to work. There is too much tension.

DR. ANDREWS: Here is a thing I do perhaps one time in twenty: When I get these extraordinarily large rings, or some case that has been operated upon and there has been a recurrence and the landmarks are destroyed from muscular atrophy, and there is nerve or muscle destruction, I use one step of the old obsolete Wolfier operation. Taking Poupart's ligament as the radius of a circle, strike a quadrant here, make a section right half way across the rectus muscle through the sheath of it, and meet that with a vertical section up through along the linea alba, thus a triangle is formed of the rectus sheath. The shape and form of the triangle is precisely that of this canal if you evert it. You can evert it and imbricate it in four different ways. You can turn that triangular flap of the anterior rectus sheath and put it in behind the cord, or you can put it in with that muscle in the same stitch over in front of the cord, or you can do the ordinary imbrication operation, leaving the rectus sheath still loose, imbricating the lower segments over the upper and taking this over all, tacking it right down through. I have done it by all methods. Dr. McArthur criticised this technique on theoretical grounds. He thought the rectus muscle being deprived of its sheath would form a ventral hernia or be a weak spot. I am disposed to think that a new sheath would develop from cicatricial tissue.

DR. ARTHUR DEAN BEVAN. I think Dr. Hessert has presented the general principles very clearly and concisely, and I always like to hear Dr. Andrews discuss this subject, because I think he knows more about it than any other man in this country. I am particularly in sympathy with the points he makes in regard to utilizing the anterior sheath of the rectus in those cases where there is a deficiency. The muscle fibers are

not worth anything. Where there is this deficiency, to attempt to cut and pull a flap of muscle fiber out of a very stiff, tense rectus is, on the face of it, not worth anything. It is not like muscle which is easily pulled out and not on tension. I have used muscle a number of times, but never with great satisfaction. It was of no value, especially because at the lower point there is a good deal of fibrous material in the rectus, and it is very tense and strong, and when there is vomiting or coughing on the part of the patient, any rigidity, of course, would pull out the soft muscle stitches from that point to this (indicating). But I do think the suggestion of Wolfier (and I have used that with more satisfaction than anything else in these cases) is very well worth while and the best resource we have in cases where there is deficiency. I am wondering if the new chapter that is being written in modern surgery on free transplants of fascia will not furnish us an opportunity or material for helping in some of these cases of too large a ring. Why could we not take a good size piece of the fascia lata and utilize it as a free transplant, as is being done so frequently in other positions? I understand the theory is that these free transplants will retain their functions of tense fibrous tissue that will give resistance provided they are put to use, and certainly it would be put to use with the intra-abdominal tension that would be placed upon it in one of these hernia operations.

I am rather inclined to think we are a little behind our European colleagues in hernia work, not from the standpoint of the technique of the operation, but from the standpoint of the anæsthetic. I rather think in the next year or two almost all of us will be doing hernia operations exclusively by the Heinrich-Brown technique of scopolamin-morphin preceding operation, and the use of a couple of ounces of 5 per cent of novocain with a little adrenalin added. Following the Heinrich-Brown technique and waiting for ten minutes after the injection, almost any hernia can be done with more comfort to the patient. I am rather inclined to think within the next few years we will see the passing of general anæsthesia in hernia work. This is particularly important in operations for strangulation. I would say without any hesitation that in strangulated hernia, with the patient a bad surgical risk from shock or from the condition of strangulation, any other technique except local anæsthesia would have to bring very definite and particular reasons for being employed.

DR. A. J. OCHSNER: The anatomical condition indicated here in these illustrations certainly

exists, but I think if one should dissect those patients later on he would find the conjoined tendon extending down in front of the rectus abdominus muscle to its inserts or in the os pubis. For practical purposes we have to deal with this condition. The operation that I have done quite frequently in such cases is to shove back the aponeurosis of the external oblique to the inner margin of the rectus, and then make a fascial flap. Instead of taking the rectus muscle as it is, I make a small flap of its external and anterior fascia, which I suture to the posterior surface of Poupart's ligament, and then take the muscle which is loosened and with two sutures bring that over to the ledge of Poupart's ligament, using the Ferguson method by leaving the cord behind. I cut the sheath in front, so that the external layer goes backward instead of making a deep flap like Wölfler. I apply the muscle sutures loosely without constricting the muscle, then I bring the internal oblique and transversalis to the ledge of Poupart's ligament and later carry the fascia of the external oblique over as far as I can by Dr Andrews' method, and then take the internal fascia and carry that away out over all the layers again. After doing that, I do not recall any case of recurrence of hernia, although I must confess I have not followed all of the cases very closely.

DR DANIEL N. EISENDRATH: There is one important point which has been brought out in this discussion by Dr Andrews, and that is the utter futility of trying to do a herniotomy by the old Bassini method when the internal oblique makes a very wide arch and there is practically no conjoined tendon. When the internal oblique or red muscle is very atrophic and is very much infiltrated with fat, the Bassini operation as ordinarily performed is often a failure. Under these two conditions the ordinary Bassini operation is of no avail because we know sooner or later the atrophic muscle pulls away from Poupart's ligament. Dr Andrews is entirely too modest in proclaiming the merits of his modification of the Bassini operation. I have done about 300 operations of this kind by his method and have never had any cause to regret it. The technique which I follow is exactly as Dr Andrews has laid it down, the only difference being that where he takes the internal oblique and internal portion of the external oblique in one suture, I think we get a nicer line of apposition in these cases if we make a continuous suture. I transplant the cord, and am careful to make the first suture include as much as I can of Gimbernat's ligament and conjoined tendon, and then put in a continuous su-

ture of kangaroo tendon up to the internal ring, bringing the red (internal oblique) muscle to the inner side of Poupart's ligament. Up to this time the suturing is interrupted temporarily while putting in another suture above after Coley, to avoid recurrence. Then after that suture I continue with the lower kangaroo suture, now pulling the internal layer of the external oblique down to Poupart's ligament. In this way we get two layers (internal oblique and the inner leaf of the external oblique) accurately in approximation with Poupart's ligament. I have given up the old Ferguson method (non-transplantation of cord) for the reason that cases have passed through my hands where other operators have had recurrences take place at the lower end of the suture line, i. e. just above the pubic bone, because you cannot get in the Ferguson operation a sufficiently elastic opening for the cord to pass through above the pubic bone without danger of recurrence. You cannot get as close and as accurate approximation of the muscles as you can if you use the Coley modification. For that reason I transplant in every case.

Another point is this: In a great many of these cases I have learned a lesson from watching Dr. Andrews' work at the Michael Reese Hospital. If you watch some of the cases with this weak internal oblique or lack of development of the conjoined tendon, where you have operated on one side, in five or six years (and in one case I recall eight years elapsed) a patient will come back with a hernia on the opposite side and you have to operate on that side. Dr Andrews has taught us, if possible, if we have these patients that have a well developed hernia on one side and have a weak internal conjoined tendon on the other side, it is better to do a pseudoherniotomy to prevent the formation of a hernia. It is a satisfactory way to do. You can usually make a diagnosis of the presence of oblique deficiency before operation. If you will take these patients and use your finger, you will find you can run the fingers well under the arching fibers, so that two or three of the fingers will go to the inner end of Poupart's ligament to the arching fibers, which is the way to make a diagnosis of a weak internal oblique before you make any incision. These points are of great importance because they show why we get many recurrences after hernia operations.

DR WILLIAM FULLER: I would like to ask Dr Andrews a question. He spoke of Dr. McArthur having criticised the method he has described for leaving a space in the rectus abdominis muscle. What have been your results, doctor?

DR. ANDREWS: The results have been satisfactory. I find this flap method an ideal one, possibly the only one on which reliance can be placed in enormous rings. One word about the rectus muscle. Dr. Hessert brings out the muscle after splitting the sheath. I cannot understand how he can get any support from the muscle. I have found it split off as rapidly as the stitches were tied. I would like to have him tell us how he gets good repair out of the muscle after he gets the sheath off of the muscle fiber.

DR. WILLIAM HESSERT: In regard to the suggestion about the muscle being tense and not coming down, that is true. For that reason, I have found this method rather unsatisfactory, because in muscular individuals the rectus is tense and you cannot get more than possibly three stitches inserted, and there is great tension and it does not look good. This method Dr. Andrews mentions is a splendid one. I have never tried it, but will bear it in mind and will try it as the occasion presents. It gives you all the support of Dr. Andrews' method plus the extra broad sheath of fascia. I think it is really far superior to the method of splitting the edge of the rectus and bringing the muscle down or a small portion of the fascia down, as Dr. Ochsner suggested, and of course in that connection we all remember that the same results can be accomplished in so many different ways. One man will do an operation one way, and another another way, and there will be no recurrence of the hernia, and they all get good results.

I should like to have heard the gentlemen discuss more the anatomy, because that is what I was mainly interested in. I should like to obtain

information from Dr. Bevan as to what he finds and calls the insertion of the fascia of the internal oblique and transversalis behind the rectus. In a large work on anatomy I was looking over—Bardeleben's "*Handbuch der Anatomie des Menschen*"—I remember finding nothing mentioned of fibers that go back of the rectus. I should like to learn more about that from Dr. Bevan.

DR. WILLIAM FULLER: I would like to ask Dr. Andrews another question. If I understood him correctly, he turns the sheath over the hernia opening. Why not slide it? What is the object of turning over the sheath of the rectus?

DR. ANDREWS: You want to keep the attachment to the outer border, as a hinge joint it swings right over into an inverted position, otherwise you would have a narrow pedicle at the bottom which would not be well nourished. It turns over like the hinge of a door, and fills the gap without tension. It is in fact almost too wide. Perhaps a little less than half the width of the anterior rectus sheath would answer as well.

DR. ARTHUR DEAN BEVAN: As to the anatomy referred to by Dr. Hessert, the external oblique, the internal oblique, and transversalis pass in front of the rectus.

DR. HESSERT: Can you demonstrate that in the living?

DR. BEVAN: Yes, of course you can.

DR. HESSERT: It is merely a clinical presentation.

DR. BEVAN: When you make your dissection, these muscle fibers become tendinous and pass into the bone from the spine of the pubes to the symphysis.

## CORRESPONDENCE

### DIABETES MELLITUS

I am undertaking an exhaustive research into the pathology, etiology, and dietotherapy of diabetes mellitus. I am very anxious to hear from every physician in the United States who has a case under treatment or who has had any experience in the treatment of this malady. Von Noorden says, "The best treatment for the diabetic is the food containing the greatest amount of starch which the patient can bear without harm." If any physician who reads this has similar or contrary experience I would esteem it a special privilege to hear from him.

WILLIAM E. FITCH, M. D.,

355 W. 145th St., New York City

### RESULTS OF THE RADICAL ABDOMINAL OPERATION FOR CANCER OF THE UTERINE CERVIX

#### A CORRECTION

In the article upon this subject by Dr. John A. Sampson, which appeared in the March number of *SURGERY, GYNECOLOGY AND OBSTETRICS*, in the body of the text the references to the pictures illustrating the article were inaccurately placed in our editorial offices. In the text for Figs. 2 and 3, read Figs. 3 and 4, and for Fig. 4 read Fig. 2.

## BOOK REVIEWS

**FRACTURES AND DISLOCATIONS** By Lewis A. Stimson, B A, M D, LL D Philadelphia and New York Lea & Febiger

By the publication of a seventh edition of his already well known and much appreciated book entitled "Fractures and Dislocations," Dr Stimson has brought his work strictly up to date on the two big and important subjects with which he deals.

The open treatment of recent fractures, with its indications and technique, a subject which of late has been causing much discussion, together with the treatment of old dislocations are the most important additions to be found in this new edition.

There are three new sections devoted to fractures of the small bones of the hand and foot, and there are more than one hundred new illustrations from photographs and skiagrams which greatly aid the practical application of the advised principles of treatment.

As in the preceding editions, the author divides his book into two parts. Part I dealing with fractures and Part II with dislocations. In each instance the subject is first dealt with as a whole in chapters devoted respectively to Pathology, Etiology, Symptomatology and Diagnosis, Mechanism of Repair, Complications, and Treatment. This is followed by a regional division of each subject, so simply classified according to anatomical arrangement that it affords an invaluable reference book in practical work.

Every fracture and dislocation is carefully considered, and particular emphasis is laid upon the different methods of reduction and fixation of each variety, together with the most detailed description of the various forms of apparatus used.

EUGENE S. TALBOT, JR.

**DIFFERENTIAL DIAGNOSIS OF DISEASES OF THE NERVOUS SYSTEM** By Henry Hun, M D Troy, N Y The Southworth Company

In this book the author makes use of charts of all kinds, in which one is able to trace the different symptoms which he has detected to the causal disease. It is also arranged so that such symptoms as he has overlooked will be suggested to the student as he passes over the explanations and illustrations.

Everyone who has studied and crammed for an examination or test of any kind knows that he can learn things from his own notes that are impossible from those of another man, while those of a third will be perfectly clear. To me it seems that this

book will fill a long-felt want to many men interested in neurology, while to others it will be impossible.

The notes are clear and the deductions from a certain group of symptoms are easily made. The illustrations are well made. Wm. R. CURRIE.

**SURGERY Its Principles and Practice** Vol VI Edited by William W. Keen, M D, LL D Philadelphia and London W B Saunders Co., 1913

In editing a sixth book, Dr. Keen has exceeded his original intention of publishing a complete system on surgery in five volumes.

The rapid strides in the development of surgery not only have resulted in the establishment of new principles of therapy, of new operative and laboratory technique, and of new theories, but have also rendered obsolete some of the procedures which were generally authorized during and just preceding the time of appearance of the original five volumes, between the years 1906 and 1909.

This supplemental volume is evidence of Dr. Keen's realization of the expansion of surgery and of his appreciation of the fact that because of this increase of surgical knowledge, no work can continue to be the standard authority even for a few years unless it is kept up to date by additions.

Although the last five years have shown great surgical advancement in every department, it has been most marked in the physiology and surgery of the hypophysis, in thoracic surgery as performed with the newer positive and negative pressure apparatus, in the administration of anesthesia by intratracheal insufflation and the intravenous ether methods, and in the chemical and electrical treatment of cancer. Not only are all of these newer subjects discussed exhaustively by surgeons whose names are intimately associated with their development, but every other surgical subject which may be found in the preceding volumes has been brought strictly up to date, in so far as the advancement has passed beyond the experimental stage.

The same policy, if possible a little more extensively carried out, of amplifying and clarifying the writers' words by the liberal use of colored plates, photographs and line drawings, of operative steps, of apparatus and of pathological specimens, renders the subject-matter assimilable and easy of application, as in the previous volumes.

In conclusion it may be said that this new edition makes the system as nearly an authority on the entire field which it covers as any work which is on the market to day. EUGENE S. TALBOT, JR.

OPERATIVE OBSTETRICS, INCLUDING SURGERY OF THE NEW-BORN. By Edward P. Davis, A. M., M. D. Philadelphia and London: W. B. Saunders Co., 1912

The appearance of a volume devoted to operative obstetrics from so distinguished an author marks a distinct advance in American medical literature. Added to the results of his clinical experience is evidence of wide reading, the various sub-headings being accompanied by bibliographies which give the text a definite value as a work of reference.

In his introduction Dr. Davis discusses very briefly the anatomy of the reproductive organs and their relations during pregnancy and labor. Emphasis is placed upon asepsis of the birth canal and the prophylaxis and control of hemorrhage. The importance is shown of regarding the pregnant woman as a surgical patient and the point that gestation toxæmia renders her a bad subject for surgical interference is well made. In obstetrics anesthesia the author prefers ether to chloroform, but rather favors the latter for short dilating operations. Thus he would use chloroform for performing version and ether for extraction. Apparently but little use has been made of scopolamin, morphin, stovain, etc.

The greater portion of the volume is taken up by Parts I and II, designated respectively as the Surgery of Pregnancy and the Surgery of Labor. As a general proposition surgical procedure during gestation is advised against except in extreme cases, such as carcinoma and ovarian tumor. In this part are considered the treatment of uterine displacements, repair of cervical lacerations, removal of uterine tumors, and operations on the appendages, on the rectum and on the perineum. Therapeutic abortion and the induction of labor are carefully discussed. Abortion is indicated in toxæmia, tuberculous, transmittable nervous or mental conditions, but not in contracted pelvis, fibromata, ovarian tumors, carcinoma, or the acute infectious diseases. In the induction of labor the bougie is preferred, with the rubber bag a second choice. The diseased appendix, gall-bladder, and kidney are treated, in general, the same as in the non-pregnant state. When abdominal section is thus performed, the author deems it justifiable, if the fœtus is viable and the maternal condition critical, to include delivery by uterine section. In ectopic pregnancy he operates on diagnosis except where, the patient being in shock, immediate operation would seem to turn the tide against her.

The extraction of the child by the vaginal route is first taken up in Part II. The lateral position is favored in spontaneous delivery. Extraction in breech presentation is very well described, indeed, and where manual extraction of the head fails, the use of the forceps on the after-coming head is indicated. Delivery by forceps is very thoroughly gone into. The use of the axis-traction instrument is strongly advocated. The illustrations of this chapter are profuse and illuminating and since the

volume is evidently intended for students as well as for the practitioner, it is regrettable that the indications are not more definitely set forth. Likewise there is no concise differentiation made between extraction in low and in high arrest, the author considering such distinction of theoretical rather than of practical import. Concerning conditions making forceps delivery justifiable the author says:

"It has been abundantly shown that the use of forceps upon the head not engaged above the pelvis or but just beginning to enter the pelvic brim is followed by dangerous pressure, often by cranial or intracranial hemorrhage, and permanent injury to the nervous system. In many cases the child dies as the consequence. With other obstetric operations as successful as are now pubiotomy and Cæsarean section, unless the child is to be deliberately sacrificed, the forceps should not be applied to the head until engagement and molding have occurred. If it is proposed to sacrifice the child, craniotomy is safer for the mother than difficult forceps extraction, the head not being engaged."

This too may well be taken to heart by many physicians. "A competent anesthetizer and assistant should be at hand, and the necessary appliances for checking hemorrhage, preventing infection, and repairing lacerations. If these conditions and surroundings cannot be commanded, a physician will do well to abstain from the application of forceps and summon competent aid."

"Failure of the head to engage and partially descend, brow presentation, parietal bone presentation, posterior rotation of the chin, a fœtus complicated by a tumor or pathological conditions making its delivery impossible, contraction at the pelvic outlet, stenosis of the vagina and pelvic floor, partial dilatation of the cervix with infiltration with malignant or scar tissue, and the presence of a dead child in a contracted pelvis, form the principal contraindications for the use of the forceps."

Dr. Davis' almost epigrammatic frankness is refreshing. Seldom in a text do we find a frequent fault as succinctly condemned as in the following:

"It may seem incredible that an educated physician would attempt to drag the fœtal head with the obstetric forceps through a pelvis too small for it. Yet those who see cases brought into hospitals and who have a consultation practice will admit with regret that such is the case. The simple rule of practice which asserts that after a reasonable time, the head not descending, it must be pulled down, and that if one physician cannot pull it down two or more can, is sure at some time to bring its follower into an obstetric disaster. It may be too much to expect the general practitioner to know and practice pelvimetry or for the recent graduate to provide himself with a pelvimeter. But recent graduates are taught to recognize engagement of the fœtal head, and general practitioners should have learned the same lesson." Many of the younger corps of teachers who have hesitated

to speak out so plainly can only feel grateful towards one of Dr. Davis' position for having written so bluntly and so truthfully.

Version, embryulcia and pubiotomy are equally well treated of and abundantly illustrated. Vaginal and abdominal Cæsarean section are concisely described, the indications for each being in accordance with the best American teaching. The results of the author's ninety-five cases of celohysterotomy are excellent. Of 72 uninfected cases, but one mother died, and of the 20 infected cases, 8 died, the twelve surviving having been treated by the Porro method. Of the first group all the children survived, of the second group six were dead at the time of operation and four died from inspiration pneumonia and birth pressure. Rupture of the uterus and inversion of the uterus comprise the subjects which complete this part of the work devoted to the surgery of labor.

Manual delivery of the placenta, hæmorrhage during and following labor, placenta prævia and premature detachment of the placenta are the first subjects considered under Part III, Surgery of the Puerperal Period. Classical Cæsarean section is advocated where the placenta covers the internal os, and rupture of the membranes with the use of a rubber bag is preferred to version where placenta prævia lateralis obtains. The treatment of placental separation is summarized as follows:

"In patients in private houses and not under the care of an obstetric surgeon the use of the tampon by the rotunda method, with or without rupture of the membranes, will control the hæmorrhage and give a reasonable chance for the mother. The survival of the child will be the exception and not the rule. In cases where a diagnosis is made early, with mother and child in good condition, delivery by section, with hospital advantages, will give the mother the best chance for recovery, with a possible chance for the child." In all cases where the patient is weakened by excessive loss of blood, section should not be undertaken and general anaesthesia should be avoided.

The immediate repair of cervical, vaginal and perineal lacerations is strongly upheld by the author, the methods of the secondary operations being also described. The correction of uterine displacements is given brief attention, and mention is merely made of post-partum relaxation of the abdominal wall. It is regrettable that greater space is not given to this latter most important border line condition, of which the author should have much to teach. The surgery of puerperal septic infection and the treatment of mastitis conclude this portion of the text. In treating pelvic thrombophlebitis Dr. Davis takes no decided stand as regards ligation or excision of the infected veins, merely regarding the operation as a justifiable procedure in the early stages of pyæmia.

The surgery of the new-born is a short chapter comprising such subjects as asphyxia, umbilical hæmorrhage, birth fractures and paralysis, injuries

to the scalp, congenital lack of development, infections of the new-born, and circumcision.

Throughout the text the reader welcomes the frequent interposition of abundant references, these providing in many instances an almost complete bibliography of the subject under discussion. Everywhere illustrations are most abundant and helpful to the text. In general the procedures described are the ones justified by the author's own experience, other methods being disregarded or merely mentioned, the only exception to this rule being the rather comprehensive consideration of the extraperitoneal Cæsarean section. In imprint the volume comes up to the standard long established by the publishers.

CAREY CULBERTSON.

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# Clinical Congress of Surgeons of North America

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FOURTH ANNUAL SESSION

CHICAGO

NOVEMBER 10 TO 15, 1913



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## CHICAGO AS A MEDICAL AND SURGICAL CENTER

### I. THE SURGEONS OF FORT DEARBORN

By M. M. QUATFE, CHICAGO

Professor of History, Lewis Institute

THE medical annals of Chicago go back to the visit of the first white explorer, and their beginning involves us in Chicago's first mystery. When Joliet and Marquette were returning from their famous exploration of the upper Mississippi in 1673, the latter was persuaded by a band of Illinois River Indians to promise to return again and instruct them. For Marquette the expedition ended at Green Bay. Here he spent the summer of 1674, worn down by the illness which was shortly to terminate his career. In the autumn, the disease having temporarily abated, he undertook the fulfillment of his promise to the Illinois Indians. With two voyageurs and accompanied by a party of Indians, the brave priest pushed his toilsome way down the western shore of Lake Michigan to the mouth of the Chicago River. Over a month was consumed in this journey, owing to the delays caused by the stormy lake. The Chicago

River was frozen to the depth of half a foot, and snow was plentiful. Marquette's malady having returned, a winter camp was made two leagues up the South Branch. Here, in his wilderness hut, the sick priest whiled away the time from December until April, the neighboring Indians vying with his two white companions in ministering to his comfort and supplying his wants. In February Marquette began a novena, or nine days' devotion to the Virgin Mother, to ask God for the restoration of his health, and shortly afterward his condition improved, in consequence, as he believed, of his devotions. Marquette found that two Frenchmen had already established themselves in northern Illinois, some eighteen leagues below Chicago, and engaged in an illicit trade with the Indians. One of them was Pierre Moreau, a noted *coureur du bois* of the time, while his companion is designated by Marquette only as "le chirurgien"—the surgeon. The

little the priest tells us of the surgeon serves only to whet our curiosity. As soon as he learned of Marquette's illness he came, in spite of snow and bitter cold, a distance of fifty miles to bring the sick man some corn and blueberries. Marquette sent Jacques, one of his two companions, back with the surgeon to carry a message to the Indians, and the traders loaded him on his return with corn and "other delicacies" for the sick priest. Furthermore the surgeon was a devout man, for he spent some time at Chicago with Marquette in order to perform his devotions. Clearly we are dealing with a character who improves with closer acquaintance. But such acquaintance is denied us. As a ship passing in the night the surgeon flashes across Chicago's early horizon, whence he came, whither he went, even his name, will probably remain forever a mystery.

The permanent establishment of the profession of medicine at Chicago dates from the founding of old Fort Dearborn in the summer of 1803. The career of Dr. Smith, the first surgeon of the Fort Dearborn garrison, and his successors, comprises an interesting, and for the most part as yet unwritten, chapter in the history of Chicago. Our information concerning the career of Dr. Smith is all too scanty. Presumably he accompanied the troops of Captain Whistler's company on their overland march from Detroit to Chicago in the summer of 1803. At any rate he had been at the post some time when he wrote, on December 9, 1803, a letter to a friend in Detroit recounting his experiences and describing the condition of affairs at the new post. Although winter was at hand the post was "not much advanced," and Captain Whistler and the garrison were housed in small temporary huts. The surgeon, however, was more fortunately situated. In partnership with John Lalime, "a very decent man and a good companion," he had rented for the winter a cabin belonging to John Kinzie, the St. Joseph River Indian trader, and fixed it up in a comfortable manner. The troops found Chicago "tolerably healthy at present," although upon their arrival they had suffered much from bilious fevers. That the improvement was but temporary is shown by a letter of Captain Whistler to his superior officer the following summer, in which he reports that over half his men had been ill. The prevailing diseases were ague and fever, long the curse of the western country.

Dr. Smith remained at his lonely station for five years. His successor at Fort Dearborn was Surgeon's Mate John Cooper of New York. Of Cooper, thanks to his friendship in after life with

General James Grant Wilson, who is still living in New York City, we know more than we do of his predecessor. Cooper's grandfather, a British soldier, fought under Wolfe at Quebec and was near his leader when he fell, mortally wounded at the moment of victory. The grandson was born at Fishkill, New York, in 1786. He was but 22 years of age, therefore, when he came as surgeon to Fort Dearborn. He journeyed to Chicago by way of Albany and Buffalo, where he boarded the brig "Adams," Commodore Brevoort's "navy of the lakes." The journey across Lake Erie consumed a week, and another week, including stops, was spent in passing through the river and Lake St. Clair and on to Mackinac. After several days' delay at the latter place, the brig proceeded by way of Green Bay to Chicago, which was reached in three days. After three years' service at Fort Dearborn, Cooper resigned from the army and returned to the East by way of the Indian trail to Detroit, which had been followed by the troops on coming to Fort Dearborn eight years before. The journey to Detroit required fourteen days. From Detroit the traveler went by way of Fort Wayne and Pittsburgh to Poughkeepsie, New York. Here he made his home and practiced his profession for over half a century, dying in 1863.

Fort Dearborn and Chicago's third resident surgeon was Isaac Van Voorhis. Like Cooper he was a native of Fishkill, New York, and a member of the same class in college to which his predecessor belonged. Van Voorhis was 21 years old when he came to Fort Dearborn, and only 22 when he was slain by the Indians in the summer of 1812, yet the few facts which have been preserved concerning him tend to the conclusion that he was a young man of unusual breadth of vision and loftiness of ideals. When asked if he was willing to go to the garrison at Fort Osage, then the remotest outpost of the government, on the Missouri, he answered: "I am ready to serve my country wherever my services may be required." In October, 1811, a few months after his arrival at the equally lonely wilderness station at the mouth of the Chicago River, he wrote to a friend in his native village in the following prophetic strain: "In my solitary walks I contemplate what a great and powerful republic will yet arise in this new world. Here, I say, will be the seat of millions yet unborn, here the asylum of oppressed thousands yet to come. How composedly would I die could I be resuscitated at that bright era of American greatness — an era which I hope will announce the tidings of death to fell superstition and dread tyranny."

Less than a year later, in the Fort Dearborn massacre of August, 1812, the young surgeon gave up his life for his country, composedly, the writer has faith to believe, in view of his ancestry and training. By a peculiar irony of fate, however, in most of the accounts that have been written of the Fort Dearborn massacre Van Voorhis has been singled out for obloquy by being portrayed as having died like a terror-stricken coward. This representation originated in an account of the massacre based mainly on family recollections and written down after the lapse of a third of a century of time. It is worthy of note in this connection that Captain Heald in his official report of the battle uttered no word of disparagement of the surgeon's conduct, announcing, on the contrary, the news of his death with "great sorrow." Commenting upon the whole incident, an eminent Chicago practitioner of a later day, Dr. James Nevins Hyde, thus concludes: "Too many surgeons have exhibited not only a consummate skill, but a splendid courage upon the field of battle, for their professional brethren to doubt the compatibility of these virtues. They will only remember, therefore, of their martyred representative in the battle of Chicago, that he was sorely wounded in the discharge of his professional duties, and that he died the death of a soldier."

That the survivors of the massacre must have sorely missed the ministrations of the slaughtered surgeon seems obvious. A number of the soldiers were wounded, some of them in grievous manner. Captain Heald had been shot twice, and never fully recovered from the wound caused by a bullet in the hip, which he carried to his grave twenty years later.

Lieutenant Helm, the other surviving officer, had a flesh wound in the heel. Mrs. Heald had received a half-dozen wounds, none of which proved permanently serious. The same family tradition which sets forth the cowardice of Van Voorhis records a crude surgical operation performed upon Mrs. Heald. Upon the refusal of an Indian chief who was reputed to possess some surgical skill to extract a bullet from her arm, John Kinzie proceeded to cut it out with his pen-knife. A grave certificate of Captain Heald, a copy of which is still preserved, sheds light upon the medical care received by him in the weeks immediately succeeding the massacre. It sets forth that while still a captive at St. Joseph he paid ten dollars to an Indian doctor for medical attendance. However crude these services may have been, the commander's lot was a happy one in comparison with that of some of his wounded

subordinates. Burns, a member of the ill-fated Chicago militia, was stabbed to death by a squaw within an hour of the close of the battle, while several of the wounded regulars were tortured to death during the ensuing night.

With the return of the garrison to the site of Fort Dearborn in 1816, came Dr. John Gale, to remain here for the two ensuing years. Soon after his arrival he was instrumental in bringing to light a story of one of the wounded survivors of the massacre of 1812 which constitutes as strange a bit of historical slotam as was ever snatched from the oblivion of the past. Because of the way in which the tale has been handed down to us, its historical accuracy cannot be vouched for by the writer, yet it possesses enough of interest to justify its inclusion here. In October, 1816, two of the men detailed to select timber for the construction of the fort were proceeding in a skiff far up the North Branch, when they came upon a half-concealed Indian hut. They were first apprised of its proximity by the shrill shrieks of the squaws, who had perceived the boat as it approached. The men were turning the boat to retreat, when they heard the voice of a white man imploring them to stop and talk with him. He informed them he was a member of the old Fort Dearborn garrison. He had been wounded in the battle, but his life was mercifully saved by an elderly squaw, whom he had often provided with something to eat. She prevented the Indians from scalping him, and with the help of her girls moved him across the river and put him under some bushes. Here the women cared for him as best they could, attending to his wounds, although both they and he suffered much from lack of food. As soon as he could be moved they tied him on a flat timber from the burned fort and dragged him to a small lake, some forty miles to the northward. Here he found himself compelled to take the old squaw for his wife or perish from starvation. Upon her sudden death, a year before the visit of the sawyers, he had taken the two older girls to be his squaws. There was a third sister, younger than these, and the three women and himself comprised the inmates of the hut.

The sawyers reported their discovery at the fort, and the next day Dr. Gale accompanied them to the hut, taking a load of presents for the squaws. It appeared that the inmates of the hut were about to remove to another location, and as a preliminary to this the soldier had taken the youngest girl to be his third wife. She was then 150 moons, or 13 years old, but had desired to be married before leaving the vicinity of her mother's burial place.

Dr. Gale examined the man's wounds and found that they had healed, but with unnecessarily poor results, one leg being shortened and one arm of little use. The surgeon took down his name and other personal details and listened to his story of the massacre. He refused to return to civilization as long as the squaws would live with him and care for him; but he promised, on condition that the little squaw should not be ridiculed by the soldiers, to bring them to visit the encampment. Nothing more was ever seen of the man, however, a fact not much to be wondered at. The surgeon wrote out an account of the interview and left it with the adjutant, by whom in some manner it was lost. That the story did not, like the wounded soldier, pass into complete oblivion, is due to the fact that it was at length written down by a student of local history, after having been preserved in memory for over three quarters of a century.

In June, 1818, Gale was promoted to the full rank of surgeon and transferred to another station. He was followed at Fort Dearborn by Dr. McMahon, whose service was terminated about a year later by ill health. The next surgeon on the roster of the Fort Dearborn garrison was William S. Madison, but within two months he was ordered to Louisville, and the scanty post returns do not establish clearly whether he was ever in fact at Fort Dearborn at all. Like Van Voorhis, Madison gave his life for his country, being killed by the Chippewa Indians in May, 1821. In September, 1821, came surgeon M. H. T. Hall, but like Madison his connection with the garrison ceased after a term of two months. In July, 1821, came a namesake, Dr. Thomas P. Hall. He continued at Fort Dearborn until the garrison was withdrawn and the post abandoned, in September, 1823. During these years the post commander was Lieutenant-Colonel John McNeil. During the war of 1812 he had twice been brevetted for gallant conduct, the first time in the battle of Chippewa, the second in the battle of Niagara. Mrs. McNeil was a half-sister of Franklin Pierce, the future president of the United States. Another member of the official family at Fort Dearborn during Dr. Hall's incumbency as surgeon was James Watson Webb, who in later life acquired a threefold fame as politician, diplomat, and journalist.

A glimpse at the daily life and amusements of these pioneer Chicago surgeons may prove of interest to their successors of the great metropolis of to-day. They shared, of course, with the other members of the garrison, the hardships and privations of life incident to their isolated wilder-

ness station. Perhaps the most obvious fact about the life at Fort Dearborn, down at least to the first withdrawal of the garrison in 1823, is that of its overpowering loneliness. From November to May the settlement was as isolated from the world at large as though on another planet. One day in October, 1817, Samuel A. Storrow, who was making a tour of the Northwest, appeared on the north bank of the Chicago River and shortly afterwards entered the fort. Its inmates, he relates, received him "as one arrived from the moon."

Necessarily, then, the inhabitants of the little settlement must ordinarily rely upon themselves for social intercourse and relaxation. The diversions of the garrison were naturally but few. Fishing and hunting, and an occasional athletic contest with the Indians who visited the fort, constituted the chief outdoor amusements. From the first discovery by the French until far into the nineteenth century the region around Chicago was a perfect hunter's paradise. When Cooper came to Fort Dearborn in 1808 the officers and most of the civilians of the place possessed horses and dogs. Cooper himself had two good saddle horses and a hunting dog. Within a week of his arrival some dogs chased three deer past the fort into the river. A young soldier, who chanced to be in a canoe without any weapon, sprang into the water as the deer were swimming past, caught one by the neck, and held its head under water until it was drowned. Cooper's dog seized the second, but the third, a large stag, gained the north bank and escaped.

We are indebted to Cooper, too, for the story of an athletic contest at Chicago, the description of which stirs the blood even after the lapse of a hundred years. Lieutenant William Whistler was a splendid specimen of physical manhood, over six feet in height and noted for his strength and powers of endurance. Among the tawny neighbors of the Fort Dearborn garrison was a Pottawatome chief of similar physique and about the same age as Whistler. He was a great runner, and enjoyed the reputation of never having suffered defeat in a race. A five-mile foot race between the two men was arranged, Whistler wagering his horse and accoutrements against the horse and trappings of the chief. Much interest, of course, was aroused over the contest. Both the Indians and the soldiers were confident of the prowess of their respective champions. The red men staked their ponies and other available property on the chief, and the whites accepted the wagers as fast as offered. The contest, which was witnessed by several hundred Indians and the

entire garrison and settlement, was won by Whistler by a margin of a few yards, after a superb struggle. The final sequel of the race, according to the same authority, came several years later and was still more thrilling. During the War of 1812 the same chief, now serving with the British, sent a challenge to individual combat to Captain Whistler or any officer or soldier of his command. The challenge was promptly accepted by Whistler himself, and the outcome of the ensuing hand-to-hand combat with knife, sword, and tomahawk was the departure of the warrior for the happy hunting ground.

The recollections of James Watson Webb of his life at Fort Dearborn in the early twenties show the garrison officers of that period to have been furious hunters. Webb describes rather minutely the hunting expeditions in which he shared. Doctor Hall maintained a pack of twenty fox hounds, and so was dubbed "master of the hunt." We learn, however, from the historian of Major Long's expedition to the source of the St. Peter's River, which passed through Chicago in 1823, that his devotion to sport did not preclude an interest in scientific pursuits. In treating of the characteristics of the Pottawatomic Indians the author acknowledges his indebtedness to a "valuable manuscript of observations" communicated to him by Dr. Hall, and especially emphasizes the value of the medical portion of his notes.

For five years following 1823 the walls of Fort Dearborn failed to echo to the sentinel's tread, and for the same period of time the inhabitants of the little Chicago settlement missed the familiar boom of the sunrise and sunset gun. The abandonment of Fort Dearborn proved premature, however, the Indians of Wisconsin became restive, and in 1828 a serious outbreak was averted only through the remarkable energy and resourcefulness of Governor Cass. Accordingly the order went forth for the reoccupation of Fort Dearborn, and in October, 1828, the new garrison arrived.

The post surgeon from this time until December, 1830, was Dr. C. A. Finley. The precariousness of posthumous fame is well illustrated by the treatment accorded him at the hands of our local historians, but one of whom, apparently, has been aware even of the surgeon's existence. Hyde, in his "Early Medical Chicago," merely alludes to him as "Dr. J. B. Finley." Hurlbut devotes several pages of his "Chicago Antiquities" to the correction of errors in Hyde's work. He fails to note, however, the misidentification by Hyde of Dr. Finley, although reference to the army register makes it plain that J. B. Finley could never

have served at Chicago. He entered the army in 1814 and left it the following year; thus the entire period of his service falls between the destruction of the first Fort Dearborn and the establishment of the second. From the same source we learn that Dr. C. A. Finley, the real Fort Dearborn surgeon, continued in the army until 1862, and in March, 1865, was brevetted brigadier-general "for long and faithful service."

Perhaps the most interesting period from the medical viewpoint in the history of Fort Dearborn was the summer of 1832. The outbreak of the Black Hawk War filled the white inhabitants of northern Illinois with consternation. Panic-stricken, they made a wild rush for places of safety, and Fort Dearborn became the haven of refuge for several hundred settlers from the surrounding country. State and national governments moved with praiseworthy vigor against the Indians, and soon General Winfield Scott was approaching Chicago with many hundred regulars drawn from various points along the Atlantic seaboard. With him came, however, a peril before which the menace of the hostile red man paled to insignificance. The Asiatic cholera had recently crossed the Atlantic to Canada. From Quebec it swept down upon New York by way of the St. Lawrence and Hudson River valleys, and gradually extended thence to west and south over the country. The pestilence fell with awful fury upon Scott's army during its voyage around the lakes, and, more potent than Black Hawk's warriors, for a time disrupted the expedition. On Scott's own vessel no fatalities occurred until Mackinac had been passed and Lake Michigan entered. Then the disease broke out suddenly and with fatal violence. The only surgeon on board became panic-stricken, drank a bottle of wine, and went to bed sick, and, to quote the disgusted commander's grim comment, "ought to have died." In this crisis Scott himself turned doctor, applying as best he could the treatment which, in anticipation of the plague, he had sought instruction upon before he left New York. As soon as the vessel reached Chicago the troops in possession of Fort Dearborn moved out and the fort was converted into a general hospital for the use of Scott's men. The settlers who had recently crowded into the settlement now engaged in quite as wild a stampede to get away.

Meanwhile the pestilence raged among Scott's stricken troops at Fort Dearborn. The official medical report shows that 200 cases were admitted to the hospital in the course of six or seven days, and that 58 of them terminated fatally. Apparently the terror inspired by the cholera was

due as much to the rapid progress of the disease as to the high percentage of mortality among its victims. On Scott's vessel men died in six hours after being in perfect health. Sergeant Heyl "was well at nine o'clock in the morning — he was at the bottom of Lake Michigan at seven o'clock in the afternoon." The author of the statement just quoted gives a graphic account of his own illness, from which at the time of writing he was in process of recovery. He was serving as officer of the day when Scott's ship reached Chicago, and superintended the landing of the sick on board. "I had scarcely got through my task," he wrote two days later, "when I was thrown down on the deck almost as suddenly as if shot. As I was walking on the lower deck I felt myself growing stiff from my knees downward. I went on the upper deck and walked violently to keep up the circulation of the blood. I felt suddenly a rush of blood from my feet upwards, and as it rose my veins grew cold and my blood curdled. . . . My legs and hands were cramped with violent pain."

Some interest attaches to the methods employed by physicians in treating the disease, especially in view of what transpired at Chicago. In general it may be said that on both sides of the Atlantic the medical profession was helpless to stay its course. The surgeon who attended Scott's men in Fort Dearborn, who was probably Dr. S. G. J. DeCamp from New Jersey, treated all cases by calomel and blood-letting. This proved so efficacious, according to his report, that he regarded the disease as "robbed of its terrors." In view of the nature of the remedies employed, and the fact that 58 of the 200 cases admitted to the hospital terminated fatally, the grounds for this satisfaction are not entirely clear. But few fatalities occurred among the members of the Fort Dearborn garrison, who had been removed some distance from the fort and were attended by another physician, Dr. Harmon. Curiously enough, he attributed his success to the fact that he *did not* employ calomel in the treatment of the disease. That some of the patients in the fort were subjected to other treatment than the calomel and blood-letting described in Dr. DeCamp's report seems evident from the statements of the officer whose sudden seizure on board

Scott's vessel has been described. He was given eight grains of opium, and made to rub his legs as fast as he could, he was also required to drink a tumbler and a half of raw brandy. At the time of writing the patient described himself as "out of danger," but whether because of this treatment it would be hazardous to affirm.

With the close of the Black Hawk War a flood of settlers poured into the country lying west of Lake Michigan. The increase of population at Chicago in the single year 1833 was many times as great as during the entire 160-year period which had elapsed since Marquette's visit to the place. Necessarily the Indian population of Illinois and Wisconsin retired before the advancing tide of settlers, and it soon became merely a question of time when Fort Dearborn would be abandoned by the soldiery for all time. The withdrawal took place on almost the last day of the year 1836. The last surgeon at Fort Dearborn Dr. Philip Maxwell, was on duty during practically all of this four-year period. His term of service, therefore, was longer than that of any of his predecessors except Dr. Smith. Maxwell had an attractive personality. "He was straight and portly in figure six feet and two inches in height, two hundred and seventy five pounds in weight," yet he was fond of dancing and "his step was as light as that of a wisp of a girl." Before coming to Fort Dearborn Maxwell had been stationed in Wisconsin, and while there became acquainted with the country in the neighborhood of Lake Geneva. Its beauty so impressed him that he later purchased an entire township of land there and established a beautiful home. He continued in the army for several years after the abandonment of Fort Dearborn in 1836, serving for a time under General Zachary Taylor in Louisiana. At length he resigned his commission and established himself in Chicago, now a flourishing city. Here he continued, an honored practitioner and citizen, until his death in November, 1859. Although he died comparatively early, he had lived to see the sprawling village of half a hundred flimsy houses to which he came in February, 1833, become the greatest city of the interior — a more wonderful transformation, perhaps, than any that has since occurred on the site of old Fort Dearborn.

## SURGICAL CLINICS

COMMITTEE. A. J. OCHSNER, Chairman, CARL BECK, FREDERIC A. BESLEY, and LAWRENCE RYAN.

*Monday, November 10th*

A. J. OCHSNER — Augustana Hospital — 8 to 1  
 JAMES J. McGUINN — Columbus Hospital — 10 to 12  
 SYLVAN KUNZ — German Hospital — 10 to 12  
 A. P. HEINECK — Jefferson Park Hospital — 10 to 12  
 G. H. WYNEKOOP — Lake View Hospital — 10 to 12  
 BENJAMIN H. BREAKSTONE — Maimonides Hospital — 10 to 12  
 E. WYLLYS ANDREWS — Michael Reese Hospital — 9 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 12  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G. BECK — North Chicago Hospital — 9 to 11  
 Bismuth work only  
 S. DAHL — Norwegian Deaconess Hospital — 9 to 11  
 M. L. HARRIS — Polyclinic Hospital — 11  
 NORMAN KERR — Polyclinic Hospital — 11  
 J. R. PENNINGTON — Polyclinic Hospital — 2 to 4  
 ARTHUR DEAN BEVAN — Presbyterian Hospital — 11 to 1  
 C. G. BUFORD — St. Joseph's Hospital — 2  
 CARL WAGNER — St. Joseph's Hospital — 10 to 12  
 W. H. ALLPORT — St. Luke's Hospital — 2  
 T. A. DAVIS — West Side Hospital — 1 to 3  
 EDWARD M. BROWN — West Side Hospital — 8 to 11  
 T. J. CONLEY — West Side Hospital — 10 to 12  
 J. V. FOWLER — Willard Hospital — 11 to 12

*Tuesday, November 11th*

N. M. PERCY — Augustana Hospital — 8 to 10  
 C. G. BUFORD — Children's Memorial Hospital — 2  
 JACOB FRANK — Columbus Hospital — 8 to 12  
 LAWRENCE RYAN — Cook County Hospital — 8 to 11  
 A. G. ZIMMERMAN — German Hospital — 9 to 12  
 PAUL GRONNERUD — German Hospital — 10 to 12  
 BENJAMIN H. BREAKSTONE — Jefferson Park Hospital — 2 to 4  
 C. I. WYNEKOOP — Lake View Hospital — 8 to 10  
 BENJAMIN H. BREAKSTONE — Maimonides Hospital — 10 to 12  
 E. WYLLYS ANDREWS — Mercy Hospital — 8 to 10  
 L. A. GREENSTELDER — Michael Reese Hospital — 8 to 10  
 L. L. McARTHUR — Michael Reese Hospital — 9 to 11  
 N. EISENDRATH — Michael Reese Hospital — 10 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 12  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G. BECK — North Chicago Hospital — 9 to 11  
 Bismuth work only  
 WM. R. CUBBINS — Post-Graduate Hospital — 2 to 6  
 DEAN D. LEWIS — Presbyterian Hospital — 9 to 11  
 CHARLES H. PARKES — Sheridan Park Hospital — 8  
 C. H. McKENNA — St. Joseph's Hospital — 9 to 11  
 C. M. McKENNA — St. Joseph's Hospital — 9 to 11  
 A. E. HALSTEAD — St. Luke's Hospital — 8 to 11  
 AXEL WERELIUS — South Shore Hospital — 9 to 12  
 W. E. SCHROEDER — Wesley Hospital — 8 to 10  
 F. A. BESLEY — Wesley Hospital — 10 to 12

E. E. HENDERSON — Frances Willard Hospital — 10 to 1

*Wednesday, November 12th*

A. G. ZIMMERMAN — Alexian Brothers Hospital — 9 to 11  
 A. J. OCHSNER — Augustana Hospital — 8 to 1  
 WM. FULLER — College of P. and S. — 1 to 3  
 WM. M. HARSHA — College of P. and S. — 1 to 3  
 CARL BECK — Cook County Hospital — 1 to 4  
 SYLVAN KUNZ — German Hospital — 10 to 12  
 B. A. McBURNEY — Hahnemann Hospital — 10 to 12  
 J. V. FOWLER — House of Correction — 9 to 11  
 E. E. TORELL — Lake View Hospital — 9 to 10  
 G. H. WYNEKOOP — Lake View Hospital — 10 to 12  
 BENJAMIN H. BREAKSTONE — Maimonides Hospital — 10 to 12  
 J. B. MURPHY — Mercy Hospital — 8 to 10  
 E. WYLLYS ANDREWS — Michael Reese Hospital — 9 to 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9 to 11  
 CARL BECK — North Chicago Hospital — 9 to 11  
 J. R. PENNINGTON — Polyclinic Hospital — 2 to 5  
 LAWRENCE RYAN — St. Anthony's Hospital — 10 to 12  
 CARL WAGNER — St. Joseph's Hospital — 10 to 12  
 A. E. HALSTEAD — St. Luke's Hospital — 8 to 11  
 CHARLES DAVISON — University Hospital — 1 to 3  
 A. P. HEINECK — West Side Hospital — 8 to 10

*Thursday, November 13th*

N. M. PERCY — Augustana Hospital — 8 to 10  
 A. J. OCHSNER — College of P. and S. — 1 to 3  
 N. M. PERCY — College of P. and S. — 1 to 3  
 JACOB FRANK — Columbus Hospital — 8 to 12  
 JAMES J. McGUINN — Columbus Hospital — 10 to 12  
 LAWRENCE RYAN — Cook County Hospital — 8 to 11  
 E. WYLLYS ANDREWS — Cook County Hospital — 9 to 12  
 A. P. HEINECK — Cook County Hospital — 1 to 3  
 A. G. ZIMMERMAN — German Hospital — 9 to 12  
 PAUL GRONNERUD — German Hospital — 10 to 12  
 H. R. CHISLETT — Hahnemann Hospital — 8 to 10  
 C. E. KAHLKE — Hahnemann Hospital — 8 to 10  
 C. I. WYNEKOOP — Lake View Hospital — 8 to 10  
 BENJAMIN H. BREAKSTONE — Maimonides Hospital — 10 to 12  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G. BECK — North Chicago Hospital — 9 to 11  
 Bismuth work only  
 WM. F. SCOTT — Oak Park Hospital — 10 to 12  
 M. L. HARRIS — Polyclinic Hospital — 11  
 NORMAN KERR — Polyclinic Hospital — 11  
 ARTHUR DEAN BEVAN — Presbyterian Hospital — 11 to 1  
 CARL B. DAVIS — Presbyterian Hospital — 11 to 1  
 C. H. McKENNA — St. Joseph's Hospital — 10 to 12  
 C. G. BUFORD — St. Joseph's Hospital — 2  
 A. E. HALSTEAD — St. Luke's Hospital — 8 to 11  
 W. H. ALLPORT — St. Luke's Hospital — 2

AXEL WERELIUS—South Shore Hospital—9 to 12  
 D. A. K. STEELE—University Hospital—1 to 3  
 F. A. BESLEY—Wesley Hospital—4 to 6  
 H. M. RICHTER—Wesley Hospital—4 to 6  
 C. C. ROGERS—Willard Hospital—10 to 12

### Friday, November 14th

A. G. ZIMMERMAN—Alexian Brothers Hospital—9 to 11.  
 A. J. OCHSNER—Augustana Hospital—8 to 11  
 EDWARD M. BROWN—College of P. & S.—1 to 3  
 F. A. BESLEY—Cook County Hospital—10 to 12  
 A. E. HALLSTAD—Cook County Hospital—10 to 12  
 GEORGE F. THOMPSON—Cook County Hospital—8 to 10  
 SYLVAN KUNZ—German Hospital—10 to 12  
 G. H. WYNEKOOP—Lake View Hospital—10 to 12  
 BENJAMIN H. BREAKSTONE—Maimonides Hospital—10 to 12  
 E. WYLLYS ANDREWS—Mercy Hospital—8 to 10  
 L. A. GREENSFELDER—Michael Reese Hospital—8 to 10  
 L. L. MCARTHUR—Michael Reese Hospital—9 to 11  
 D. N. EISENDRATH—Michael Reese Hospital—9 to 12  
 EMANUEL FRIEND—Michael Reese Hospital—9 to 12  
 CARL BECK—North Chicago Hospital—9 to 11  
 J. R. PENNINGTON—Polyclinic Hospital—2 to 4  
 CHARLES J. ROWAN—Presbyterian Hospital—11 to 1  
 CARL WAGNER—St. Joseph's Hospital—10 to 12  
 M. J. SEIFERT—St. Mary's of Nazareth Hospital—8 to 10

W. E. SCHROEDER—Wesley Hospital—8 to 10.  
 ALLEN B. KANAVEL—Wesley Hospital—4 to 6.  
 T. J. CONLEY—West Side Hospital—10 to 12.

### Saturday, November 15th

N. M. PERCY—Augustana Hospital—8 to 10  
 F. G. DYAS—College of P. & S.—1 to 3  
 JACOB FRANK—Columbus Hospital—8 to 12.  
 E. WYLLYS ANDREWS—Cook County Hospital—9 to 12  
 C. E. HUMISTON—Cook County Hospital—10 to 12  
 PAUL F. MORF—Cook County Hospital—1 to 4.  
 A. G. ZIMMERMAN—German Hospital—9 to 12  
 H. R. CHISLETT—Hahnemann Hospital—8:30  
 C. E. KAILKE—Hahnemann Hospital—8:30  
 C. I. WYNEKOOP—Lake View Hospital—8 to 10.  
 H. A. MOJE—Lake View Hospital—10 to 11  
 BENJAMIN H. BREAKSTONE—Maimonides Hospital—10 to 12  
 J. B. MURPHY—Mercy Hospital—8:30 to 12  
 CARL BECK—North Chicago Hospital—9 to 11  
 EMIL G. BECK—North Chicago Hospital—9 to 11.  
*Bismuth work only*  
 S. DAHL—Norwegian Deaconess Hospital—9 to 11  
 PAUL GRONNERUD—Polyclinic Hospital—2 to 4.  
 D. W. GRAHAM—Presbyterian Hospital—2 to 5.  
 W. H. ALLPORT—St. Luke's Hospital—2  
 AXEL WERELIUS—South Shore Hospital—9 to 12  
 W. E. SCHROEDER—Wesley Hospital—10 to 12  
*Days and Hours to be Announced*  
 JAMES BERRY—Illinois Steel Co. Hospital  
 S. C. PLUMMER—St. Luke's Hospital

## GENITO-URINARY SURGICAL CLINICS

COMMITTEE LOUIS E. SCHMIDT, Chairman, WM. T. BELFIELD ROBERT H. HERBST, GUSTAV KOLISCHER, VICTOR D. LESPINASSE

### Monday, November 10th

GUSTAV KOLISCHER—Michael Reese Hospital—9 to 11  
 L. W. BREMERMAN—Office—4 to 6

### Tuesday, November 11th

HERMAN L. KRETSCHMER—Alexian Brothers Hospital—8 to 10  
 B. C. CORBUS—College of P. & S.—8 to 10  
 HARRY A. KRAUS—German Hospital—4 to 5  
 L. W. BREMERMAN—Lakeside Hospital—8  
 ROBERT H. HERBST—Polyclinic Hospital—4 to 6

### Wednesday, November 12th

L. L. SCHMIDT—Alexian Brothers Hospital—9 to 11  
 F. KREISSL—Jefferson Park Hospital—2 to 3  
 GUSTAV KOLISCHER—Michael Reese Hospital—9 to 11  
 L. W. BREMERMAN—Office—4 to 6

### Thursday, November 13th

L. W. BREMERMAN—Lakeside Hospital—8  
 ROBERT H. HERBST—Polyclinic Hospital—4 to 6.  
 J. S. NAGEL—West Side Hospital—3 to 5.

### Friday, November 14th

HERMAN L. KRETSCHMER—Alexian Brothers Hospital—8 to 10  
 D. N. EISENDRATH and FRENCH S. CARY—College of P. & S.—2 to 4  
 HARRY A. KRAUS—German Hospital—4 to 5.  
 F. KREISSL—Jefferson Park Hospital—2 to 4  
 LOUIS E. SCHMIDT—Michael Reese Hospital—9 to 11  
 B. C. CORBUS—Post Graduate Hospital—3 to 6.  
 WM. T. BELFIELD—Presbyterian Hospital—4  
 L. W. BREMERMAN—Office—4 to 6

### Saturday, November 15th

L. W. BREMERMAN—Lakeside Hospital—8  
 V. D. LESPINASSE—Wesley Hospital—3:30



## GYNECOLOGICAL AND OBSTETRICAL CLINICS

COMMITTEE J. CLARENCE WEBSTER, Chairman, FRANK T. ANDREWS, CHARLES S. BACON and THOMAS J. WATKINS

*Monday, November 10th*

HENRY BANGA — Polyclinic Hospital — 10.  
 THEODORE J. DOEDERLIN — German Hospital — 9  
 FRANK T. ANDREWS — Mercy Hospital — 8 to 10  
 EMIL RIES — Post-Graduate Hospital — 9  
 WM. B. FLHRING — Rush Medical College — 11  
 ARTHUR H. CURTIS — Wesley Hospital — 9  
 ROBERT T. GILLMORE — Wesley Hospital — 10  
 MARK T. GOLDSTINE — Wesley Hospital — 10 30

*Tuesday, November 11th*

GILBERT H. WYNEKOOP — Lake View Hospital — 2 to 4  
 CHANNING W. BARRETT — Polyclinic Hospital — 10  
 A. B. KEYES — Polyclinic Hospital — 3 to 4  
 ALBERT GOLDSPOHN — Post-Graduate Hospital — 11  
 CAREY CULBERTSON — Rush Medical College — 11  
 W. M. THOMPSON — St. Joseph's Hospital — 9  
 PHILIP S. DOANE — St. Joseph's Hospital — 2 30  
 W. S. BARNES — Wesley Hospital — 3

*Wednesday, November 12th*

HENRY F. LEWIS — Cook County Hospital — 3 30  
 LESTER FRANKENTHAL — Michael Reese Hospital — 9  
 FRANK W. LYNCH — Presbyterian Hospital — 11 to 1  
 J. CLARENCE WEBSTER — Presbyterian Hospital — 11  
 N. SPROAT HEANEY — Rush Medical College — 11  
 E. C. DUDLEY — St. Luke's Hospital — 2  
 ARTHUR H. CURTIS — Wesley Hospital — 9  
 MARK T. GOLDSTINE — Wesley Hospital — 10 30

*Thursday, November 13th*

A. B. KEYES — Cook County Hospital — 3 to 4  
 GILBERT H. WYNEKOOP — Lake View Hospital — 2 to 4  
 FRANK T. ANDREWS — Mercy Hospital — 8 to 10  
 C. V. BACHELLE — Polyclinic Hospital — Afternoon  
 HENRY BANGA — Polyclinic Hospital — 10  
 CHANNING W. BARRETT — Polyclinic Hospital — 10

WM. B. FEHRING — Rush Medical College — 11  
 PHILIP S. DOANE — St. Joseph's Hospital — 2 30  
 W. S. BARNES — Mercy Hospital — 3  
 ROBERT T. GILLMORE — Wesley Hospital — 10  
 THOS. J. WATKINS — Wesley Hospital — 9

*Friday, November 14th*

A. B. KEYES — Polyclinic Hospital — 3 to 4  
 ALBERT GOLDSPOHN — Post Graduate Hospital — 11  
 CAREY CULBERTSON — Rush Medical College — 11  
 W. M. THOMPSON — St. Joseph Hospital — 9

*Saturday, November 15th*

LESTER FRANKENTHAL — Michael Reese Hospital — 9  
 FRANK W. LYNCH — Presbyterian Hospital — 11 to 1  
 J. CLARENCE WEBSTER — Presbyterian Hospital — 11  
 N. SPROAT HEANEY — Rush Medical College — 11  
 THOS. J. WATKINS — Wesley Hospital — 9

*Days and Hours to be Announced*

CHARLES S. BACON  
 E. S. BAILEY — Hahnemann Hospital.  
 HENRY T. BYFORD — West Side Hospital.  
 FRANK CAREY  
 PETER S. CLARK  
 JOSEPH B. DELEE — Mercy Hospital, Wesley Hospital  
 W. A. NEWMAN DORLAND  
 DAVIS S. HILLIS — Provident Hospital  
 J. C. HOAG — St. Luke's Hospital  
 RUDOLPH W. HOLMES — Augustana Hospital  
 GUSTAV KOLISCHER  
 FRANKLIN H. MARTIN  
 B. A. MCBURNEY  
 CHARLES E. PADDOCK — St. Luke's Hospital  
 CHARLES B. REED — Wesley Hospital  
 ERNEST SAURENHAUS — West Side Hospital  
 GEORGE SCHMAUCH  
 L. S. SIMON — Michael Reese Hospital  
 HERBERT MARION STOWE  
 BERTHA VAN HOUSEN — West Side Hospital

## ORAL SURGICAL CLINICS

COMMITTEE TRUMAN W. BROPHY, Chairman, THOMAS L. GILMER and WM. H. G. LOGAN

*Days and Hours to be Announced Later*

THOMAS L. GILMER — St. Luke's Hospital and Northwestern University Dental School  
 HERBERT D. BLACK — St. Luke's Hospital and Northwestern University Dental School  
 WM. H. G. LOGAN — Francis Willard Hospital.

TRUMAN W. BROPHY — Presbyterian Hospital and Francis Willard Hospital  
 HERBERT A. POTTS — Northwestern University Dental School  
 FREDERICK B. MOOREHEAD — Presbyterian Hospital

## OPHTHALMOLOGICAL CLINICS

COMMITTEE WM H. WILDER, Chairman, EDWARD V L BROWN and CASSIUS D WESTCOTT

*Monday, November 10th*

WILLIS O'NANCE — Illinois Charitable Eye & Ear Infirmary — 2 30  
 G W. MAHONEY — Polyclinic Hospital — 9  
 W. FRANK COLEMAN — Post-Graduate Hospital — 4  
 WILLIAM H WILDER — Rush Medical College — 2 30

*Tuesday, November 11th*

CHARLES H BEARD — Illinois Charitable Eye & Ear Infirmary — 2 30  
 ALFRED N MURRAY — Lake View Hospital — 1 to 3  
 CHARLES H FRANCIS — Polyclinic Hospital — 9  
 GEORGE F. SUKER — Post-Graduate Hospital — 9

*Wednesday, November 12th*

J B LORING — College of P and S — 3  
 OSCAR DODD — Illinois Charitable Eye & Ear Infirmary — 2 30  
 S MEAD HAGER — Polyclinic Hospital — 9  
 W. FRANK COLEMAN — Post-Graduate Hospital — 9  
 GEORGE F SUKER — Post-Graduate Hospital — 2

*Thursday, November 13th*

WM H WILDER — Illinois Charitable Eye & Ear Hospital — 2 30  
 G W. MAHONEY — Polyclinic Hospital — 9.

*Friday, November 14th*

H W WOODRUFF — Illinois Charitable Eye & Ear Hospital — 2 30  
 ALFRED N MURRAY — Lake View Hospital — 1 to 3  
 CHARLES H FRANCIS — Polyclinic Hospital — 9  
 W I FRANK COLLMAN — Post-Graduate Hospital — 4.

*Saturday, November 15th*

E V L BROWN — Illinois Charitable Eye & Ear Hospital — 2 30  
 S MEAD HAGER — Polyclinic Hospital — 9  
 GEORGE F SUKER — Post Graduate Hospital — 2

*Days and Hours to be Announced Later*

C GURNEE FELLOWS — Hahnemann Hospital  
 RICHARD J TIVNEN — Mercy Hospital  
 MORTIMER FRANK — Michael Reese Hospital  
 E. F. SNYDACKER — Michael Reese Hospital  
 BROWN PUSEY — Northwestern University and Wesley Hospital  
 CASEY A WOOD — St Luke's Hospital  
 FRANK ALLPORT — St Luke's Hospital  
 CASSIUS D WESTCOTT — St Luke's Hospital  
 WM F GAMBL — University Hospital

## LARYNGOLOGICAL AND RHINOLOGICAL CLINICS

COMMITTEE FREDERICK MENGE, Chairman, WM I BALLENGER, and JOHN EDWIN RHODES.

*Monday, November 10th*

STANTON A FRIEDBERG — Cook County Hospital — 2 to 4  
 CHARLES M. ROBERTSON — Polyclinic Hospital — 2 30 to 5

*Tuesday, November 11th*

JOSEPH C BECK — Cook County Hospital — 3 to 6  
 OTTO T FREER — Polyclinic Hospital — 4 to 5  
 CHARLES H LONG — Post Graduate Hospital — 8 30 to 12

*Wednesday, November 12th*

BURTON HASLITINE — Hahnemann Hospital — afternoon  
 OTTO J STEIN — Post Graduate Hospital — 2 to 5  
 FREDERICK MENGE — Wesley Hospital — 8 to 12

*Thursday, November 13th*

JOSEPH C BECK — Cook County Hospital — 3 to 6.  
 RICHARD H BROWN — College of P and S — 9 to 11

CHARLES M ROBERTSON — Polyclinic Hospital — 2 30 to 5  
 CHARLES H LONG — Post-Graduate Hospital — 8 30 to 12

*Friday, November 14th*

STANTON A FRIEDBERG — Cook County Hospital — 2 to 4  
 OTTO T FREER — Polyclinic Hospital — 4 to 5  
 WM L BALLENGER — College of P and S — 10 to 12

*Saturday, November 15th*

JOSEPH C BECK — Cook County Hospital — 3 to 6  
 CHARLES H LONG — Post-Graduate Hospital — 8 30 to 12  
 ARTHUR M CORWIN — West Side Hospital — 8 30.

*Days and Hours to be Announced Later*

FRANK E BRAWLEY — St Luke's Hospital.  
 MORTIMER FRANK — Michael Reese Hospital  
 J HOLINGER — St Elizabeth's Hospital  
 GEORGE P MARQUIS — St. Luke's Hospital  
 JOHN E RHODES — Presbyterian Hospital.

## ORTHOPEDIC CLINICS

COMMITTEE E. W. RYERSON, Chairman, WALLACE BLANCHARD, CHARLES M. JACOBS, JOHN L. PORTER and HENRY B. THOMAS

*Monday, November 10th*

E. W. RYERSON — Children's Memorial Hospital — 3 to 6, Polyclinic Hospital — 1 to 2.  
THOMAS P. LYNAM — Home for Destitute Crippled Children — 2 to 4

*Tuesday, November 11th*

JOHN L. PORTER — College of P. and S. — 9 to 11, Home for Destitute Crippled Children — 11 to 1  
WALLACE BLANCHARD — Home for Destitute Crippled Children — 2 to 4

*Wednesday, November 12th*

E. W. RYERSON — Children's Memorial Hospital — 3 to 6, Polyclinic Hospital — 1 to 2  
P. B. MAGNUSSON — Home for Destitute Crippled Children — 2 to 4

*Thursday, November 13th*

HENRY B. THOMAS — Cook County Hospital — 11 to 12  
E. W. RYERSON — Home for Destitute Crippled Children — 2 to 4

*Friday, November 14th*

WALLACE BLANCHARD — Home for Destitute Crippled Children — 2 to 4  
E. W. RYERSON — Polyclinic Hospital — 1 to 3

*Saturday, November 15th*

C. M. JACOBS — Home for Destitute Crippled Children — 2 to 4

## OTOLOGICAL CLINICS

COMMITTEE NORVAL H. PIERCE, Chairman, J. HOLINGER and GEORGE F. SHAMBAUGH

*Monday, November 10th*

IRA FRANK — Michael Reese Hospital — 9  
JOSEPH BECK — North Chicago Hospital — 3 to 6  
J. GORDON WILSON — Northwestern University Medical School — 10  
J. HOLINGER — St. Joseph's Hospital — 9  
T. MELVILLE HARDIE — St. Luke's Hospital

*Tuesday, November 11th*

JOSEPH BECK — County Hospital — 3 to 6  
H. H. BOETTCHER — Illinois Eye and Ear Infirmary — 2  
DAVID FISKE — Polyclinic — 2, 30  
FRANK ALLPORT — St. Luke's Hospital — 2 General eye, ear, nose and throat clinic

*Wednesday, November 12th*

J. HOLINGER — Alexian Brothers Hospital — 9  
JOHN T. CAVANAUGH — Chicago Eye, Ear, Nose and Throat Hospital — 3 to 6  
NORVAL H. PIERCE — Illinois Eye and Ear Infirmary — 2  
JOSEPH BECK — North Chicago Hospital — 3 to 6  
O. J. STEIN — Post Graduate Medical School — after noon  
FRANK ALLPORT — St. Luke's Hospital — 2 General eye, ear, nose and throat clinic

*Thursday, November 13th*

DAVID FISKE — Children's Memorial Hospital — 1 to 3  
JOSEPH BECK — Cook County Hospital — 3 to 6

ALFRED LEWY — Hahnemann Hospital — 2, 30  
CHARLES H. ROBERTSON — Polyclinic — 2, 30  
IRA FRANK — Michael Reese Hospital — 9  
J. HOLINGER — St. Joseph's Hospital — 9  
A. H. ANDREWS — Wesley Hospital — morning

*Friday, November 14th*

W. A. BALLENGER — College of P. & S. — 10 to 12  
H. H. BOETTCHER — Illinois Eye and Ear Infirmary — 2  
JOSEPH BECK — North Chicago Hospital — 3 to 6  
DAVID FISKE — Polyclinic — 2, 30  
GEORGE F. SHAMBAUGH — Rush Medical College, Senn Hall — 2  
FRANK ALLPORT — St. Luke's Hospital — 2 General eye, ear, nose and throat clinic

*Saturday, November 15th*

J. HOLINGER — Alexian Brothers Hospital — 9  
JOSEPH BECK — Chicago Eye, Ear, Nose and Throat Hospital — 3 to 6  
JOHN T. CAVANAUGH — Chicago Eye, Ear, Nose and Throat Hospital — 3 to 6  
GEORGE W. BOOT — Children's Memorial Hospital — 1, 30  
NORVAL H. PIERCE — Illinois Eye and Ear Infirmary — 2  
J. GORDON WILSON — Northwestern University Medical School — 10

# SURGERY, GYNECOLOGY AND OBSTETRICS

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## ORTHOPEDIC PRINCIPLES IN THE TREATMENT OF ABDOMINAL VISCEROPTOSIS AND CHRONIC INTESTINAL STASIS<sup>1</sup>

By JOEL E. GOLDTHWAIT, M. D., BOSTON

THE justification for the orthopedist having concern with the subject of visceroptosis is to be found in the following facts

1. Abdominal visceroptosis is invariably associated with disturbances of poise, which must result in weakness of the muscles and strain of the joints. The joint strain is manifested chiefly in the feet, knees, sacroiliac joints and low back, and shoulders. When the congenital type of visceroptosis exists, the disturbance in poise shows even in childhood.

2. The imperfect poise associated with visceroptosis results in a gradual weakening of the trunk muscles, with consequent lessening of this part of the support for the trunk as well as for the viscera.

3. The imperfect poise, commonly showing as the droop of the shoulders and flattening of the chest, must of itself cause downward displacement of the abdominal organs, with possible interference with their function, even though the formation of the organs, together with their ligaments, was wholly normal in the beginning.

4. Many of the chronic joint diseases are probably due to the disturbed physiology resulting from the malposition of the viscera as well as possibly to absorption from the gastrointestinal tract.

5. Treatment of the joint strains resulting from the postures associated with visceroptosis, as well as the treatment of the joint diseases, due to disturbances of the abdominal viscera, is incomplete, and many times hopeless, unless the viscera are properly treated so that undue strain is relieved and their normal function made possible.

6. The best health and greatest efficiency of the individual is possible only when the body is used in such poise that there is no undue strain or interference with any of the structures.

In the presentation of a paper upon this subject it is hardly necessary before such a gathering as this to enter into the discussion of the different types of visceroptosis more than to mention the fact that there are the two general types, the congenital and the acquired, and that in both of these types will be found many variations in the size, shape, or general formation of the special viscus.<sup>1</sup>

To understand the general principles which underlie the work of the orthopedist it is necessary to know something of that which takes place in the postures assumed in such cases.

When the human figure is held fully erect (Fig. 1), the chest is raised, the ribs are

<sup>1</sup>L. T. Swain. Study of Thirty Nine Cases as Regards Intestinal Length and Nutrition. Boston M. & S. J. Aug. 21, 1912.

<sup>2</sup>Read before the Clinical Congress of Surgeons of North America. New York City. November 13, 1912.



Fig. 1

flared at the bottom the diaphragm is high, and there is a very considerable space under the ribs in the abdomen in which the stomach, liver and spleen lie, almost covered by the lower border of the ribs. Not only is there ample space for these organs, but when these organs are held in place there is ample room for the other viscera in the lower portions of the abdomen. In this position the muscles of the abdomen are contracted so that the abdominal wall is firm and there is the best possible support in the front and sides for the various viscera. Also, in this position, with the abdominal muscles tight and with the abdomen flat the total depth of the abdominal cavity at the level of the last lumbar vertebra represents only about one third of the full depth of the body (Fig. 2), and this depth is practically the same all the way across, the lateral spinal spaces being filled with the wings of the ilia, the psoas muscles, and the retroperitoneal fat. Above this point the cavity rapidly deepens and the

lateral spinal spaces are free for the viscera. The kidneys are almost entirely posterior to the anterior portion of the spine (Fig. 3), while the liver fills much of the lateral spinal space on the right side. If the body is erect the kidneys are so placed in the lateral spinal spaces, surrounded by the retroperitoneal fat (Fig. 4), that their inclination is backward and upward so that there is no tendency to fall forward or sag downward. Also when the body is fully erect the liver is held in place partly by the kidney and the retroperitoneal fat below, but very considerably by the grasp of the lower ribs with the spine (Fig. 5), entirely apart from the support which it receives from the hollow viscera and its suspensory ligaments.

If the body droop (Fig. 6), the shape of the abdominal cavity changes at once. The ribs are necessarily inclined downward, and since the anterior part of the ribs is below the costovertebral articulations, it is inevitable that in the downward movement there is a corresponding backward movement of the anterior portion. This results at once in a material lessening of the space under the ribs, with the effect that the upper abdomen is made much smaller than normal. In this position, since the diaphragm is attached to the anterior portion of the ribs, it must also move downward.

These two elements, the downward movement of the diaphragm and the contracting of the space under the ribs, mean that the liver and the stomach are crowded downward into other positions. In such an attitude not only are the ribs flattened and the diaphragm lowered, but since the support of the body is thrown almost wholly upon the posterior muscles, the abdominal muscles are relaxed. This being the case (Fig. 7), the abdomen protrudes or becomes prominent anteriorly with the effect that not only is there less support for the organs but that the depth of the abdominal cavity is materially changed, with the result that all of the organs tend to assume a lower level. In this downward movement or droop of the body, since the posterior attachments of the diaphragm are so low that they come down well behind the upper part of the kidneys, as the diaphragm is

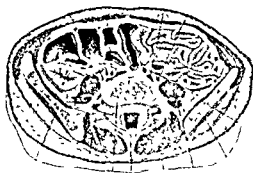


Fig. 2 (Dwight)

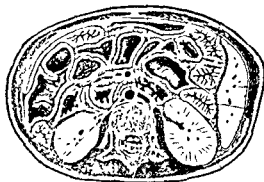


Fig. 3 (Dwight)

lowered the kidneys are necessarily dragged forward at the top. To still further affect the position of the kidneys, since the liver rests partly upon the right kidney, and since undoubtedly there is some pressure from the stomach upon the left kidney, as these organs are forced downward the kidneys are forced downward also. The continued pressure of the organs from above upon the kidneys naturally results in the absorption of the fat tissue surrounding them, and this portion of their support is taken away.

In this downward displacement not only are these organs affected, but since the colon, if it has its normal attachment, is attached at the hepatic angle directly under the liver, in the downward displacement, the movable portion of the colon must be forced downward with the effect that the angle is made sharper and very possibly may be shut off as the result of the force of the downward pressure.

On the left side a similar condition occurs as the result of the pressure or drag of the stomach against the left side of the transverse colon, with a resulting interference with the lumen at the splenic angle. In this condition also the small intestine assumes a lower level, partly because of the relaxation of the anterior abdominal wall and partly because of the pressure from above.

When the body is fully erect the axis of the abdominal cavity should be almost at a right angle with the axis of the pelvic cavity. In the droop of the body, however, the axes are

changed so that the thrust of the viscera of the abdomen can be received much more directly into the pelvis.

The pressure which such displacement of the intestines must mean upon the organs of the pelvis is perfectly obvious, the possible result being not only interference with the function of the organs by the direct pressure, but by pressure upon the vessels and nerves supplying them.

With such an understanding of the relationship of the organs in the different positions it is at once obvious that if a kidney is sutured in place, and the shape of the body which was responsible for the displacement of the organ is allowed to remain, the result will be most unsatisfactory, the same condition being certain to recur. The same thing is true in regard to the operations which are performed commonly upon the stomach and intestine, which must fail in much of their possibility of benefit unless at the same time the body is remodeled so that the normal relationship of the other parts is restored. It should also be apparent that frequently the fixing of an organ in place makes the adjustment of the organs as a whole more difficult than before. This has been strikingly shown in a case which the writer had great difficulty in relieving in which the splenic flexure and the hepatic flexure of the colon had been sutured in place in a patient who had had a congenital ptosis with a free mesentery on all the organs. The two fixed points, with the natural drag of

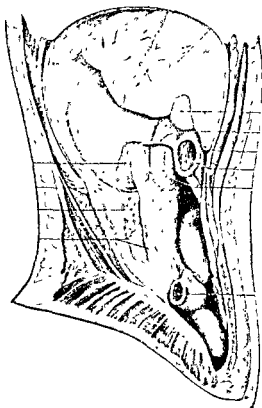


Fig 4 (Corning)

all the other loose organs upon these two fixed points, naturally makes greater difficulty in the passage of the waste around these angles than existed before. It is perfectly evident to the writer that many of the cases of surgery and medicine which now represent a reproach to our profession are unsatisfactory because only the purely local element has been appreciated in treatment. If the profession could be made to see that a displaced stomach or a displaced colon or a displaced kidney or the imperfect working of any special organ has its relation to all of the other parts, and should be considered in connection with the other parts, many of the cases which are now perplexing would be easily understood, while many of the cases which are justifiably operable would yield results far different from those now obtained.



Fig 5 (Sabotta)

#### TREATMENT

The ideal which the orthopedist has in the treatment of such conditions is to restore the body as nearly as possible to the normal poise, in which the proper relationship may exist in all its parts. In this he fully appreciates that it is impossible to change the general shape of the special organ or the general character of the ligamentous attachments. In other words, if the congenital type exists, that type must always exist. He appreciates, however, that the best function of an imperfect organ,



Fig. 6 Typical attitude of congenital visceral ptosis. Note the downward inclination of the ribs, the backward inclination of the body from the hips.

Fig. 7 Attitude, congenital visceral ptosis. More extreme than Fig. 6. Note downward inclination of the ribs, backward inclination of the body, narrowing

of the upper abdomen, prominence of the lower abdomen.

Fig. 8 Same patient as Fig. 6. Photograph taken four months later. Note the width of the lower part of the thorax, the ribs having been raised as the result of treatment. To the lower part of the brace an abdominal pad is attached to give support over the lower abdomen.

as well as the best function of a perfect organ cannot take place unless all acquired or unnecessary interference is removed. It is well known to those who have given special study to this subject that even when the congenital type exists, these patients rarely have symptoms in early life indicative of visceral disturbance. The symptoms which have developed later are undoubtedly due to the increase of the downward displacement of the organ or the peculiarity in its formation which must come from the long continued use of the body in the upright position. Since Nature's plan is to repair damage, it is reasonable to expect that the relief of the strain which

resulted in such symptoms will be followed by improvement, with the retraction of the visceral ligaments, exactly the same as takes place in a relaxed joint with the removal of strain.

It is felt by the writer both from general reasoning as well as from extensive experience, that a good prognosis is usually possible in such conditions if the acquired features of disturbance of poise and visceral sag can be overcome.

The correction of the poise or the remodeling of the body is at times comparatively simple and can be accomplished by the use of simple apparatus and special exercises without



Fig. 9 Same patient as Figs. 6 and 7, showing the jacket with the body hyperextended, the ribs raised to their maximum. This position was impossible in the beginning and was accomplished by several different jackets.





Fig 10 The hyperextended position. Note the position of the pillow at the dorsolumbar juncture, with the marked prominence of the anterior portion of the lower ribs

interfering with the active life of the individual, but at other times the condition is so severe that more radical measures are necessary.

Whenever the disturbance of poise in such cases has been long existent not only is the relationship between the bones changed, but there is a marked change in the muscle tone of the body. The anterior muscles of the trunk weaken as the result of disuse, since in this position the strain is thrown almost wholly upon the muscles of the back, with the result that there is a gradual weakening of these back muscles. To attempt to improve the position of the body by exercises alone with such a muscular condition present means increasing the muscle weakness with a dis-

tinct interference with the general recovery. The first step, therefore, is to rest the parts which have been overstrained and to stimulate the parts which have been weakened from disuse. This at times can be accomplished by the use of a brace (Fig. 8), which not only has for its purpose the relief of the strain to the spinal muscles, but also the correction of the poise, the elevation of the chest, the forcing of the lower ribs forward and upward and furnishing support for the pelvis and the lower part of the abdomen. While this apparatus is being worn, massage, stimulating bathing, etc., are all of advantage in hastening the repair. As soon as the evidences of muscle fatigue have passed, active exercises should be started with the idea of gradually strength-

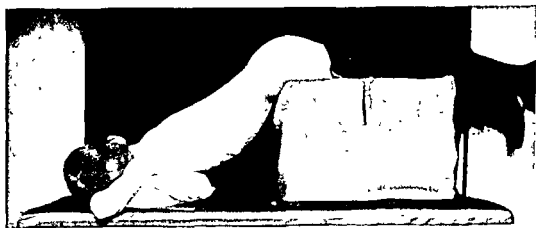


Fig 11 The prone hanging position

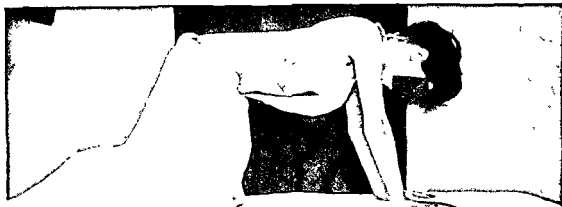


Fig 12 The same patient as Fig 6 taken before treatment was started showing the marked hollow in the lumbar region, due to the absence of the retroperitoneal fat. Also note the change in the position of the ribs brought about by simply assuming this posture.

ening all the muscles of the trunk so that ultimately the poise of the body can be maintained without artificial aid. The brace at such times is gradually omitted, the pelvic belts and lighter supports being substituted for varying periods.

In the severer cases recumbency is absolutely necessary and since in such cases considerable visceral disturbance may take place as the result of the recumbent posture care must be taken that the body is so held that this tendency is made as little as possible. The common experience that the nights are times of much distress, with disturbed sleep, much gas in the bowel, abdominal pain, the dragged feeling in the morning, with the weak pulse and the subnormal temperature, finds explanation if the anatomic formation is considered.

To prevent the sag of the organs which must occur as the muscle reflexes disappear in sleep, a leather jacket should be used which is molded from a cast of the body taken when the body is fully extended and with the ribs fully raised. Such a jacket (Fig 9) is worn during the night and in such a jacket the patient is allowed to move about or change from back to side or face at will, knowing that whatever position is assumed, harmful interference with the viscera is reduced to the minimum. The quality of the sleep resulting from such support is at times in striking con-

trast to the quality existing before the apparatus was applied.

In the severe cases recumbency is insisted upon both day and night at times for periods of many weeks, this being necessary partly because of the faulty position of the ribs, with the retraction of the ligaments at both the costovertebral and vertebral articulations. With the body horizontal, the downward sag of the organs is naturally relieved, but it must be remembered that sag in other directions may be quite as harmful in the function of the organs as occurs when the patient is erect. The attacks of vomiting when the patient is kept for long upon the back, with the many and irregular painful abdominal conditions, usually find an anatomic explanation and are usually relieved by change of posture. The position insisted upon in the daytime is with the patient upon a flat bed, with not more than one pillow under the head, preferably none at all, with a small pillow under the back to prevent the backward sag of the lumbar spine, or with the jacket above described, with frequent changes of position to the side or face. Occasionally the foot of the bed is raised to still further assist gravity in the replacement of the organs. The hyperextended position (Fig 10), in which the diaphragm is raised to the extreme, should be taken for at least a half hour after each of the meals, when the stomachic digestion is



Fig. 13 The same patient as Fig. 6, showing the posture four months after the beginning of the treatment. The patient still wearing the brace, over which is fitted a proper corset, the corset making firm pressure over the lower part of the abdomen, but leaving the upper abdomen and lower ribs entirely free.

most active. Besides this, either the knee-chest position or the prone hanging position (Fig. 11), should be taken at intervals, not only to raise the diaphragm and elevate the ribs, but also to allow the abdominal organs to sag into the upper part of the abdomen. If the stomach has had difficulty in discharging its contents into the duodenum, because of its low position, not infrequently the mere assuming of the knee-chest position or the prone hanging position is sufficient to relieve the difficulty. Not only is this true, but usually such positions are followed by improvement in the function of the intestine, so that not only is that part of the digestion carried on better, but the interference with the movement of the bowel is markedly lessened.

In such cases, as part of the bad postures, the ribs are narrowed at the bottom, producing an acute angle at the border of the costal cartilages. The recumbent position and the

special positions with the apparatus should be continued until the lower ribs have not only been raised, but until they have flared sufficiently to change the costal angle from an acute angle to at least a right angle, if not an obtuse angle. This at once assures the space in the upper abdomen under the ribs in which normally the stomach and liver lie.

The recumbent treatment should be maintained also until the general nutrition of the body has improved sufficiently for the retroperitoneal fat, which is almost entirely lacking (Fig. 12) in the extreme cases of the congenital ptosis, to be replaced. This can easily be determined by palpation through from front to back in the loin and over the lateral spinal spaces.

When it is considered wise for the patient to go about, a brace (Fig. 8) is worn at first, and if the patient is a woman, over this a carefully fitted corset (Fig. 13) is also worn. Special exercises are given for the purpose of increasing the muscle tone, and as the strength increases the brace is omitted, the pelvic belt with low abdominal support being substituted. With women this is needed for only a few weeks, after which a corset fitted to give firm support over the pelvis and low abdomen, with no constriction of the upper abdomen or low ribs, is all that is required. With men, the pelvic belt should be worn until the muscles are fully strong and the understanding of the correct poise is so perfect that there is no tendency to acquire the bad postures.

Supervision of such a case should naturally be continued at intervals for a long time for the purpose of preventing relapses. The Patients should be made to understand the harm of badly fitted costumes and the great care that should be taken at all times to see that, whatever the occupation, the body is not allowed to flex "in the middle," the bending which may be necessary being at the hips, the trunk as a whole being kept straight.

If such an understanding of the subject is held, the writer feels that not only is the prognosis good in many of these cases now considered hopeless, but that such understanding offers opportunities of team work between the physician, the surgeon, and the orthopedist that shows our profession at its best.

THE THYROID AND PARATHYROID PROBLEM<sup>1</sup>

By JASPER HALPENNY, M. A., M. D., C. M., WINNIPEG

Lecturer in Surgery, Manitoba Medical College, Surgeon to Winnipeg General Hospital

THOUGH there has been a great deal of progress made during recent years in the thyroid and parathyroid problem, the time has not yet arrived when positive statements can be made with reference to all of the phases of the question. In spite of the fact that large numbers of cases of goiter are being treated surgically with more or less beneficial results, it seems quite safe to predict that the ultimate solution of the problem has not been reached. Furthermore, during the last five years, owing to the many reports of experimental work in the case of the parathyroids, these glandules have occupied the attention of surgeons and others possibly too much.

Regarding the etiology of enlargement of perverted secretion of the thyroid gland we are still in doubt. Probably the most direct evidence during recent years is that given us by Chambers (1) and McCarrison (2). Before the British Medical Association, Chambers reported as follows: "Many attempts have been made to find evidence of organism infection. Several hundred sections have been made in some cases, and have been treated by various methods for showing organisms in tissues. Bacteriological examination, including animal inoculation, has been made in a few cases. The results have been entirely negative. Nevertheless, the histological characters suggest a toxic substance present in the thyroid gland — in some cases diffuse, in others localized. As to the nature and origin of this substance, we are at present entirely in the dark."

In 1909 McCarrison reported his work in India. Water from a known goitrous well was filtered through a Berkfeld house filter. The filtrate was given in quantities of four ounces in milk each morning before breakfast to six healthy young men between 18 and 20 years of age. During the experiments all six were kept under the closest observation in order to avoid errors. Five of these developed

goiter, and one of them was subsequently cured by means of thymol. McCarrison himself was the subject of the next experiment. He had resided in a goitrous district for five years without any enlargement of the thyroid gland. Water for his house was obtained from a well notorious as a non-goiter-producing water. Care had been taken by all Europeans to avoid the disease. Each morning before breakfast, during the experiment, he consumed half a tumblerful of the Kashrote water suspended matter, prepared in the same way as in the preceding experiment. At the end of fifteen days the neck had increased 2 cm in size, and there was found to be uniform enlargement of the thyroid gland. The experiment was continued nine days longer, during which time the gland fluctuated somewhat in size. At one time he was hardly aware of the presence of the enlargement, while at another, and especially at night, it gave him distinct discomfort.

Following this experiment, McCarrison next boiled the water and repeated the experiments both on himself and seven other men, with entirely negative results. He then concludes that goiter is due to matter suspended in water, and that this matter is not mineral but a living organism. Moreover, McCarrison adds additional color to his theory that thyroid in his district is due to an infection, because he reports 68 cases of goiter cured by the administration of thymol. "The main action of this drug," he says, "is a local one in the intestine, owing to the fact that in the absence of oil, alcohol, or other of its solvents it is very sparingly absorbed. Its curative action is very strong, though not conclusive, evidence that the habitat in man of the organism responsible for the production of goiter is the intestinal tract." He goes on to say that "further evidence on the point is afforded by the differential blood counts in cases of the disease. I have found eosinophilia of 8.9 per cent as an average of sixty-

<sup>1</sup> Read before the British Columbia Medical Association, at Victoria August 20 1912

five cases which I have examined by this method."

Short (3) does not agree, however, that such evidence as this points strongly in favor of infection. He says, "It is quite in accordance with the common laws of nature to find a metal or mineral specially limited to a particular geological formation in widely separated areas, but there is no evidence that bacteria are dependent on geology; and it has recently been shown by numerous observers that the waters of a goiter well retain their power to cause goiter in rats after filtering out all bacteria by a *Berkfeld filter*, but not after heating to 80° C. The heating probably precipitates the metal as an insoluble carbonate, by driving off the carbon dioxide, which it holds in solution."

Thus, Short rather holds the view that goitrous water owes its goiter-producing qualities to minute traces of some metal having a great affinity for iodine, and forming with it an insoluble compound

As was intimated at the commencement of this paper, the thyroid problem is intricately woven into the parathyroid problem. Despite the positive statements of many experimenters, voiced by Tuholske (4), who says the generally accepted view is that "After the removal of the thyroid gland the parathyroids never change structurally, never get like, never resemble thyroid tissue, and never assume its functions," it would seem wise to withhold judgment before accepting such positive views. Thompson and myself (5) showed a series of illustrations in which the thyroid after parathyroidectomy closely approximated the histological structure of the parathyroid after thyroidectomy. That is to say, after the parathyroids are removed the thyroid is changed in histological appearance to be somewhat intermediate between normal thyroid and parathyroid. Similarly, the parathyroid, after thyroidectomy, loses its typical appearance, and in place of the solid columns forming the normal parathyroid, definite vesicles appear, some of which contain colloid material. There is marked hypertrophy of the whole gland as well.

Furthermore, the question becomes more complicated still, for evidence is at hand to

show that probably the pituitary gland and the thyroid may act vicariously for one another, or at least that they may have a function more or less common to one another. As Short says, "Oversecretion of the pituitary gland, as we shall see, results in overgrowth of the bones, and may lead to gigantism. On the other hand, inadequate thyroid secretion will stunt the growth of bones, as is seen in cretinism." In addition to this clinical evidence, histological changes observed also give even stronger evidence. After thyroidectomy in rabbits, Herring (6) reported as follows: "Remarkable changes are at once apparent in the posterior lobe of the pituitary gland, and particularly that portion of it which lies next to the pars intermedia. Masses of a colloid nature lie among the cells and fibers of the pars nervosa. In the neck of the posterior lobe the colloid is even more plentiful."

Rogowitsch (7), Vasalle and Generali (8), and Edmunds (9) also found that the pituitary acts vicariously for the thyroid.

In work recorded elsewhere the author (10) reported changes found in the pituitary of a dog after parathyroidectomy. In this case the animal lived till the thirty-third day and died in convulsions. The pars intermedia of the pituitary gland showed distinct and numerous vesicles which histologically resembled normal thyroid. The vesicles were lined with a regular circle of epithelial cells precisely as in the thyroid; the colloid contents seemed to be of the same character as in the thyroid.

Thus we see that there is considerable evidence to show that the thyroid, the parathyroids, and the pituitary gland have some features in common, and that they may to some extent act each for the other. And the problem becomes even more complex when we view the research work of the various investigators. Rogers makes out a strong case in favor of an intimate relationship, both physiological and pathological, between the thyroid, the pancreas, and the adrenals. His experiments and his interpretation of them are very convincing. From his findings he seems quite justified when he says, "Apparently goiter or symptoms referable to the thyroid may occasionally be entirely secondary to

other disturbances, and the superficial deformity seems often to be only a hypertrophy which is compensatory to a failure elsewhere."

Even with this evidence all before us we are compelled to admit that much still remains to be learned about these glands. Though this uncertainty is very disquieting from a clinical standpoint, it is wise for us as surgeons to refrain from allowing ourselves to dogmatize to such an extent that our surgical treatment is based on errors etiological, physiological, and pathological.

It is assumed by most writers that exophthalmic goiter is due to a hypersecretion of the thyroid gland. This view is probably correct, nevertheless, our knowledge of the internal secretion of this gland is still very deficient. The exceedingly careful article of Carlson and Woelfel (11) on this subject tends to emphasize the paucity of definite facts. They have shown that the lymph production in the normal thyroid is slight, and that it is increased in all types of enlargement of the gland. They state, however, that there is no relation between the iodine content of the gland and the lymph production. Furthermore, they were unable to find any difference between the common neck lymph and the lymph of goiter, except that the latter contains pure lymphocytes. They made chemical tests for iodine in the thyroid lymph with negative results, intravenous injections of thyroid lymph in dogs, both with and without anaesthesia, produced negative results. Complete elimination of the thyroid and parathyroid lymph for forty-eight hours in normal foxes gave negative results. The whole rôle played by iodine is still an open question. They conclude their article with this paragraph.

"We have as yet no undoubted or adequate test for the thyroid-parathyroid secretions in the body fluids. When such tests are discovered, it will in all probability be found, in view of what is now known concerning the distribution and paths of all their internal secretions, that these secretions are more concentrated in the blood than in the lymph, and that they enter the blood directly, rather than indirectly through the gland lymphatics."

Another method of approach, of course, is the one adopted by Reid Hunt (12) and many

others, viz: a chemical analysis of freshly removed glands. The majority of these observers have directed their attention to a determination of the iodine content of the thyroid gland in health and disease. The most recent and correct determination is possibly that of Riggs (13). He found on an average 0.3 mg of iodine per grain of the gland substance. In the thyroid of Graves' disease, however, this is decreased to 0.2 mg., or even less than 0.1 mg., and the less iodine per grain of the gland, the more severe the symptoms are, as a rule.

Rogers' analysis of the gland has been undertaken from a different viewpoint. He has been able to isolate two entirely different substances, each more or less free from the other. One of these he terms a "nucleoproteid," which he supposes represents the epithelial portion of the gland. The other he terms "globulin," which represents the colloid. Regarding the action of these two substances there seems to be very marked physiological differences shown between them. If ten to fifteen minims of a 1:1000 solution of the human thyroid nucleoproteid is injected subcutaneously into a normal individual at intervals of a couple of hours, it invariably and soon produces tachycardia, accelerated respiration, cutaneous flushing, slight elevation of temperature with a subjective feeling of heat, sweating, tremor, insomnia, and a sensation of nervousness. When thyroid globulin is injected subcutaneously into a normal individual in the same dosage as the nucleoproteid, there seems to be little or no effect except a feeling of well-being, and a very large amount must be administered and for a much longer time, to obtain the characteristic signs of thyroidism.

This faithful attempt at a complete analysis will, as Ochsner (15) says, no doubt lead ultimately to a complete knowledge of the chemical and physiological features of the thyroid secretion. In view of these findings it would seem well, for the present, to still hold open minds as to whether there is a hypersecretion or a perverted secretion. True, the numerous pathological reports such as Wilson's (16) regarding the reduplication of the basement membrane in the vesicles in the

gland, with the accompanying change in the epithelium found in exophthalmic goiter, suggest increased or hypersecretion, also the known beneficial results in partial thyroidectomy suggest the same answer. Still, until we have some definite demonstration of the secretion itself and of the increased amount secreted in Graves' disease, we cannot hold the problem to be settled.

Again, the complexity of the relationship existing between Graves' disease and myxedema tends rather to cast doubt over the generally accepted theory rather than to clear the situation. True, myxedema occurs in the absence of the thyroid gland. In 408 cases in Kocher's clinic, complete extirpation of the gland was followed by myxedema in 69 cases. Experimentally Horsley (17) and Edmunds (18) claim to have produced mild myxedema in monkeys. Munk (19) and Vincent and Jolly (20), however, were unable to confirm these findings. Gunn and myself (21) also reported elsewhere a series of experiments on the monkey with negative results.

Clinically, many factors are thought to have a bearing on the production of goiter. Temporary enlargement of the thyroid is known to occur during menstruation and pregnancy. Stengel (14) also points out that tremor, palpitation, rapidity of heart action, and fullness of eyes occurring occasionally in anemia are due to hyperthyroidism. He thinks this is true also of certain circulatory disturbances and also certain nervous conditions. In Graves' disease fright is held to be a common cause. A review of the various causes assigned, from a clinical standpoint, would probably be merely a recital of occasions when an already existing Graves' disease became so aggravated that the patient's attention was directed to it or a simple goiter took on the graver form. It would be well for us in taking the histories of our cases to keep this point in mind.

#### TREATMENT

Amongst the various forms of treatment at the present time, the most spectacular is removal of part of the gland. Various forms of medical treatment are recommended and they are chiefly directed toward counteracting or

eliminating the supposed excessive secretion. Various forms of diet are also prescribed with the object of decreasing the secretion. One is probably right in stating that at the present time the chief drug which seems to have directly beneficial effects is quinine hydrobromate. X-ray, radium, injections of boiled water, and carbolic acid also have their enthusiastic advocates. These, however, are established on an entirely empirical basis. McCarrison's administration of thymol, however, is based on what to himself seems a rational foundation—that goiter, as he finds it in India, is due to a micro-organism.

The administration of iodine and the commercial preparation of thyroid extract is, in the light of our present knowledge, not to be recommended, though it may be ultimately proven that the primary enlargement of the thyroid gland in many cases is due to the effort of the gland to gather more iodine from the blood. It does not follow from clinical experience that the administration of iodine is beneficial. Thyroid extract, if it contains all the essentials of the gland, can only be useful after the case has passed over from being one of Grave's disease to the condition of myxedema.

The most rational treatment, possibly, which has been presented so far is the subcutaneous injection of Rogers' serum. This observer seems fairly justified when in referring to this treatment, he says: "This serum seems as specific and beneficial in its effects on the symptoms of acute toxic thyroidism as is the antitoxin on those of diphtheria; but the convalescence is protracted, and after the subsidence of the acute symptoms the anti-thyroid serum must not be 'pushed' unduly. In acute exacerbations of chronic thyroidism it must be used with caution, and not beyond the period at which it seems beneficial. In the usual chronic case of exophthalmic goiter, except when the blood pressure is high or above 150 mm. of hg., it is slowly beneficial, and often curative when administered at intervals of two or three days and continued for weeks or months. It cannot with safety be administered oftener than once in twenty-four hours, and if at any time at the end of two or three days it has intensified

rather than alleviated symptoms it should be stopped."

During recent years, in the surgical treatment of goiter, particularly of the exophthalmic variety, the chief advances have probably been made by Crile (22) of Cleveland and Dunhill (23) of Melbourne. The most painstaking and exhaustive work by Crile and his associates has shown that the elimination of fear by the administration of morphin and scopolamin prior to the giving of the general anæsthetic has reduced in their hands the number of devitalized brain cells very materially. The use of nitrous oxide in place of ether has also reduced the devitalized cells to one quarter. This work is recorded from their experimental laboratory. Crile's now famous method of anæsthetizing the patient with Graves' disease in such a way that the patient does not know that the anæsthetic is being given has been a great advance. The use of nitrous oxide in place of ether is also undoubtedly of immense value.

Dunhill's work is probably the most remarkable ever recorded. He does not use a general anæsthetic. Local anæsthesia is gained by using seven ounces of 2 1000 novocain. With this all the tissues of the front of the neck are well infiltrated. The most remarkable feature about his work, however, is that he operates on cases showing the most advanced muscular changes, including very badly weakened hearts. In fact he refuses practically no cases. He emphasizes particularly the need for operating gently, without any crushing of the tissues. Keeping in mind the fact that he refuses practically no case, his operative results are indeed remarkable. He had four deaths in 380 operations of all classes, of these 230 being of the exophthalmic variety.

The value of ligation of the vessels of the thyroid gland without removal of the latter has clinical evidence to support it.

In conclusion, one is compelled to admit that there is still a very great deal to be learned. The relationship between the thyroid and parathyroid glands and other of the ductless glands is still one of the unsolved physiological problems. Clinical knowledge has made some advances, but after many gropings in the dark, many steps thought to

be thoroughly scientific have been taken on some false assumption or some premature experimental finding thought at first well-founded. However, in spite of our lack of knowledge on many points, clinically, we know that perfect rest of body and mind is of great value. This, of course, merely gives the patient a chance to cure himself, and after all, that is exactly what modern treatment does in the major part of tuberculous conditions.

The surgical treatment of goiter, both of the simple and exophthalmic varieties, in the light of clinical evidence chiefly, is appropriate in many cases. Rogers' serum ranks as one of the greatest advances. However, even in the hands of its originators it has not fulfilled expectations. It has a field to fill, and that field has not yet been defined clinically. We must look for further light before its use can be considered specific.

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## CHRONIC INTESTINAL STASIS<sup>1</sup>

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THE subject of chronic intestinal stasis which has been chosen as the basis of this discussion, is one in which I have been intensely interested for many years. When I first began to draw the attention of the profession to the great part played in the life history of the individual by a delay in the passage of material along the alimentary tract, and drew a parallel between the human digestive canal and a drainage system, my observations were treated as being the fantasies of a vivid imagination. Later, when the accuracy of these observations was being tested in the field of hard fact, the more progressive observers began to realize that my premises were not so fanciful as was at first supposed. Now, the subject of chronic intestinal stasis, and its disastrous sequelæ, is occupying the attention of the profession more completely every year. Those who were inclined to scoff at the suggestion of the need for any operative treatment of such a harmless and everyday condition as simple constipation are now beginning to realize that the operations which I have devised are in reality directed against a most serious condition in which constipation in itself plays but the part of a common and by no means essential symptom. To many members of our profession constipation apparently means merely the absence of a daily action of the bowels, but what I mean by chronic intestinal stasis is an abnormal delay in the transmission of the intestinal contents through some portion or portions of the gastro-intestinal

tract, which delay may be accompanied by constipation or by a daily or even more frequent action of the bowels.

What is intestinal stasis from a common-sense point of view, freed from the bias of a creed which has been instilled into us in our medical infancy? The gastro-intestinal tract is a living, sentient, drainage scheme, of which the several portions perform several functions, from which nutrient material is picked up by absorbing vessels, and into which certain organs discharge their contents. In some portions organisms thrive normally, in others the presence of the same organisms produces poisonous products which that segment of the tract is unaccustomed to deal with. These poisons, being absorbed, damage the tissues of the body, causing them to degenerate and reducing their capacity to combat successfully organisms which may invade them. Any delay in the passage of the contents of this drainage scheme has a threefold result on the organisms found in the intestine. Their multiplication is facilitated, they extend beyond the limits of their normal habitat, and extraneous strains are developed. These organisms may extend along the ducts of the organs which open into the drain pipe, and they or their products, carried in the blood stream, may infect organs which do not directly communicate with the intestine, for example, the kidneys.

The excess of these poisons circulating through the body cannot be dealt with effectively by those organs whose business it is to

<sup>1</sup>Read before the Clinical Congress of Surgeons of North America, New York City, November 23, 1912.

render them as innocuous as possible. They produce progressive degenerative changes in every tissue and a very definite and unmistakable series of symptoms results.

The liver and other organs which convert the toxins, the heart and vessels which convey the products of conversion, and the kidneys and organs which eliminate them, all show after a time distinctive evidences of overwork, which, when they produce symptoms, are regarded as separate entities and are called diseases. In common with all the other tissues of the body, these structures suffer from being nourished with more or less impure blood, and their textures are injured in consequence. I need hardly call your attention to the remarkable confirmation of my views which are afforded by Carrel's magnificent work in the growth of tissues. He shows that death of tissues is due to an inability to eliminate waste products and that by draining them effectually and supplying suitable nutrition he gives them immortality.

The changes undergone in intestinal stasis by the ductless glands open up a vast field of interest. The part played in the suprarenal glands for example, assuming that our idea of their function is correct, must be a most important one. Nothing can be more striking than the pigmentation of the skin which occurs in stasis, or its abrupt disappearance when the supply of poison has been stopped. A patient who has been coppery or mahogany colored for years, will resume an appearance of health within a few days of the removal of the large bowel. The comparative rarity of fatal cases of so-called Addison's disease is a striking instance of the capacity of these wonderful little organs to hold their own under difficult conditions. Again what are the mechanics of the general low temperature, which is especially to be noted in the extremities of those patients who are the subjects of chronic intestinal stasis? Is its purely a cardiac matter, or do the ductless glands play an important part?

The rapidity with which this low temperature disappears, and the color and feel of the extremities improve after ileocolostomy, is even more striking than the removal of pigment from the skin, often taking merely a few hours.

We are but touching the fringe of a most important subject, and it is one which the surgeon, if he will cease to be satisfied with treating end results in a routine manner, has more opportunity of elaborating than the physiologist or physician.

The nervous system is also markedly affected in intestinal stasis, and as an illustration of this fact, I would call your attention to the case of a woman suffering from *tic douloureux* who had been sent to me from South Africa for removal of her Gasserian ganglion. She had suffered severely from this trouble for eight or nine years, and during the last two years her life had been intolerable, in that she experienced constant pain exaggerated by several violent agonizing outbursts during the day. Never having been able to satisfy myself that the excision of this ganglion is a scientific operation, I refused to perform it in the circumstances. I found, and my opinion was supported by the X-ray examination, that she was suffering from marked stasis and she stated that she obtained more relief from purgatives than any other medical treatment. We short-circuited her, and for a week after the operation she continued to have pain in the right side of her face, but without exacerbations. All pain disappeared completely on the eighth day. Excepting that she had a slight attack of pain at the end of the fifth week, her progress was marvelous, in that her general health improved rapidly, her weight increased and a smiling, happy, bright expression replaced one of the most miserable and hopeless imaginable. This case merely shows in an exaggerated manner the effect of autointoxication on the nervous structures, and as I have frequently observed it in a lesser degree and have cured it by removing the stasis, it points again to the fact that it is better and more scientific to treat primary causes than to deal with end results.

Need I remind you of the degenerative changes in the breast associated with stasis, and which disappear if the drainage scheme be properly dealt with, but which if left alone not infrequently terminate in cancer? When I first pointed this out it was ridiculed by a number of surgeons, but I see that it is rapidly

becoming accepted by many observers who have confirmed it by pathological evidence.

There are many other conditions, such as the several changes in the thyroid, which are in my opinion the results of chronic intestinal stasis and which are very possibly in certain stages better treated by removing the primary cause than by dealing with the end results. By doing this not only is a progressive disease cured, but the general nutrition and health of the patient are vastly and steadily improved. I refer here not only to exophthalmic goiter but also to adenomatous growths in the thyroid.

Such are the results of delay; what then are its causes? Obstruction in the drainage scheme may occur in the first place at the points of normal fixation, or in the second place the intestine may become kinked by acquired bands, etc., which, formed in the first instance by nature with the object of facilitating drainage, may have later come to cause very material obstruction.

There are several sites in the length of the alimentary tract at which this obstruction may occur, and I would first direct your attention to the mode of control of the contents of the duodenum by the kinking which occurs at the junction with the jejunum. It is somewhat difficult to determine what is meant anatomically by the duodenum, since it varies in its arrangement, but I shall regard the first mobile portion of bowel as jejunum. The vertically placed termination of the duodenum is firmly secured to the root of the transverse mesocolon. From this point in normal conditions the jejunum forms a gentle curve allowing of the free passage of the contents of the duodenum into the small bowel. If, however, there be any marked stasis of the contents of the small intestine due to control of the ileal effluent, the commencement of the jejunum is pulled vertically downwards in such a manner that the duodeno-jejunal junction is obstructed by a kinking and also by a twisting of the bowel, and the effluent is controlled proportionately.

If the condition of obstruction be advanced, a new mesentery running from the outer aspect of the jejunum outwards and upwards to the structures in the immediate vicinity is

found to have been formed. This mesentery is obviously the crystallization of resistances which tend to support the weight of the jejunum, and by taking that weight directly off the duodeno-jejunal junction, prevents obstruction at that junction as far as possible. While this acquired ligament may be useful in its early stages, it finally opposes the normal functioning of this portion of the intestine much in the same way as does the acquired ligament that forms at the end of the ileum.

In order to obviate the development of this mechanical disability the commencement of the jejunum, by an evolutionary process, becomes attached by peritoneal bands from left to right to the under surface of the transverse mesocolon in such a manner that in its highest state of development the fixed bowel forms an almost complete circle.

Between the normal condition at birth and this high evolutionary type all grades are found, each presenting a varying degree of disability. I have indicated diagrammatically in Fig. A what I believe to be the usual condition at birth; in Fig. B the condition commonly present in advanced duodenal obstruction in chronic intestinal stasis (the arrows indicate the acquired ligament, which represents the crystallization of lines of force, and which is frequently present and which is evolved to take strain off the termination of the fixed bowel); and in Fig. C the fully developed fixation of the jejunum to the under surface of the transverse mesocolon. The arrows in this diagram indicate the acquired mesenteric bands which are evolved to fix the bowel in this situation in order to obviate angulation at its termination and consequent interference with the effluent. The advantageous mechanical arrangement afforded by this last type may be imitated by suturing the jejunum to the under surface of the transverse mesocolon after the division of any such bands as are shown in Fig. B should they exist. It would seem impossible to eradicate from some minds the idea that these acquired bands and mesenteries are inflammatory in origin.

We see, therefore, that nature recognizes the advantages of a fixation of the first part of the jejunum to the under surface of the transverse

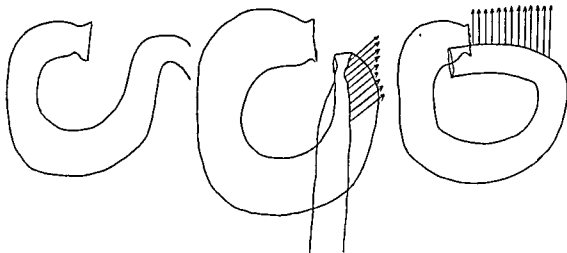


Fig. A

Fig. B

Fig. C

mesocolon so that it lies at right angles to the termination of the duodenum. This rectangular fixation tends to obviate kinking at the duodeno-jejunal junction. The surgeon unconsciously brings about the same effect by his operation of gastro-enterostomy.

The temporary relief that follows this operation when performed for ulcer of the duodenum is thus explained, since whether an anterior or posterior operation is chosen, the jejunum is so fixed that it can no longer exert traction on and so kink the duodeno-jejunal flexure. The so-called "no loop" operation affords the additional advantage of establishing an even greater strain on the beginning of the jejunum in a horizontal or upward direction. The absence or presence of an aperture of communication is, I believe, a matter of no moment unless at a later period the duodenal ulcer should cicatrize and so obstruct the normal outflow from the stomach.

However, in the consideration of the question of duodenal obstruction and ulceration, it must be clearly borne in mind that the obstruction at the end of the duodenum is itself secondary to obstruction at the end of the ileum. The obviation of the duodenal obstruction by the fixation of the jejunum, therefore, in no way affects the obstruction at the end of the ileum, and the infection of the dammed back contents of the small intestine

continues as before the operation. At the same time the operation has reduced the tension in the duodenum, and if the inflammation of the mucous membrane resulting from this distention has ended in ulceration, the ulcer heals.

It is a striking fact in the examination of patients suffering from distention of the duodenum that tenderness over the duodenum is the only symptom observed by the patient, who is quite unconscious of the tenderness associated with the obstruction at the end of the ileum until his attention is drawn to it by the manipulations of the surgeon.

This duodenal tenderness is in my experience generally regarded by the surgeon as evidence of duodenal ulcer or distention of the gall-bladder; should he find on operation that neither condition exists, he removes the appendix, on the supposition, I presume, that even a normal appendix may produce this symptom. A fair proportion of patients on whom I have operated for chronic intestinal stasis have previously experienced this treatment, frequently at the hands of surgeons of great eminence. Such a mistake as this would seem to be unjustifiable with our present means of diagnosis. A surgeon has no right to operate until he has exhausted every possible means of diagnosis at his disposal. If expert X-ray evidence were obtained instead of relying alone on a digital

examination of the abdomen, a number of such mistakes could be avoided.

It appears to me that the point of greatest difficulty in the passage of material contents along the gastro-intestinal tract is through the last few inches of the ileum. This is particularly the case when the cæcum has been securely fixed by acquired adhesions in the iliac fossa. In such cases, the delay in the passage of material at the pelvic brim may be very great, and indeed in one of my cases, Dr Jordan found on X-ray examination that the bismuth was delayed for 85 hours in the terminal coil of the ileum.

At the operation on this case there was no evidence of obstruction to the ileum in either of the more usual forms, namely by an acquired peritoneal band or by an appendix fixed in such a position behind the small bowel as to control the passage of its contents. Now this form of simple obstruction, which cannot be recognized at the time of the operation, and which can only be determined by bismuth and X rays, I call the simple static variety, as opposed to the more obvious varieties which I have just mentioned. These latter are readily recognized when the abdomen is opened, though the effect on the passage of the intestinal contents can only be gauged by bismuth and X rays. If with an uncontrolled ileal termination the delay may be very considerable, it will be obvious that a structure which by strain or pressure exerts apparently but a comparatively slight constricting influence on the lumen of the bowel may affect very materially the passage of material through it.

I will now pass on to a consideration of the sites of excessive absorption of toxins from the gastro-intestinal tract. Since the profession has begun to study the subject of autointoxication in chronic intestinal stasis, it has been inclined to assume that the large bowel is the sole source from which these toxins are derived, and it has got into the habit of looking on stasis as being purely colonic.

In consequence of this, operations have been conceived chiefly with the object of facilitating the passage of material through the colon, and in this manner the chief site of absorption

has been overlooked and left untreated. This is largely due to Metchnikoff's views on the subject. He considers that if we had no large bowel we should live longer. This is perfectly true, as evidenced by the fact that the removal of the large bowel results in a marvelous improvement in the health and appearance of the individual and prolongs his life, but I would point out that this improvement does not prove that the colon is the chief site from which toxins are absorbed in excess. Indeed in a considerable proportion of cases, I believe the bulk of the absorption takes place from the small intestine.

Stasis in the small intestine, with the associated infection of its contents by organisms to which it is unaccustomed, is not primary, but is secondary to stasis in the colon. In other words, if it were not for the presence of the colon the conditions producing stasis in the small intestine would not arise. If the cæcum did not become overloaded as a part of a colonic stasis, obstruction at the end of the ileum would not develop. Consequently infection of the contents of the small intestine by extraneous organisms would not occur, the duodenum would not be blocked by the drag of the small intestine obstructed at the end of the ileum, the mucous membrane of the duodenum would not inflame and ulcerate, the biliary and pancreatic ducts would not be infected, and obstruction to the outflow from the stomach with all its sequelæ would not occur.

I hold that the extraordinary improvement that results from short-circuiting and from the disconnection or removal of the colon is due largely to the fact that the evacuation of the contents of the small intestine is facilitated by its introduction into the pelvic colon, and that the infection of its contents by organisms which grow in the material stagnating in the large intestine ceases abruptly. I do not wish to suggest that all absorption of toxins takes place from the stomach and small intestine, but I consider that the tract other than the colon plays an important, and, I believe, the more important, part in this process.

How are these cases treated? They are given germicidal drugs, which would appear to

me to act by diminishing the number and virulence of the offending intestinal organisms. I refer to such medicines as arsenic, iron, mercury, etc. Or they are supplied with organisms which are intended to antagonize the growth of deleterious organisms in the intestine, or vaccines of these organisms are injected into the circulation to effect the same purpose. Or they are given increasing amounts of irritating substances called purgatives, with the object of hastening the passage of the contents of the intestine, and so affording less time for infection of the contents by organisms and for the absorption of their products. Or they are cut off the use of such foods as decompose readily and produce poisonous material. Or they are given large quantities of water, to wash away as rapidly as possible the poisons that have been absorbed into the circulation and tissues. They are massaged and exercised, in order to stimulate the intestinal contents to move on. They have their stomachs washed out when material is dammed back and decomposes, and they have the large bowel flushed by abundant quantities of water, frequently containing antiseptic or irritating material. This represents the medical treatment and the essence of the so-called "cures" which frequently effect a temporary alleviation of symptoms. All these forms of treatment are tedious, dangerous and at the best only palliative. Much more benefit can be obtained by the use of pure liquid paraffin administered at regular intervals during the day. This substance has, as far as is known, no chemical action whatever; it cannot be absorbed in the human intestines, while it facilitates very materially the passage of the intestinal contents. The motions cease to be firm, and they are much less bulky than before, for the reason that the amount of organisms which forms a considerable proportion of normal faeces is greatly diminished. By the use of a spring support controlling the lower abdomen, any accumulation of faecal matter in the ileum or in the caecum, or in a prolapsed transverse colon, is obviated as far as possible, while the pressure on the veins of the splanchnic area keeps the brain better supplied with blood and more

capable of carrying on its functions efficiently.

This treatment is adequate, providing the mechanical obstruction produced by one or more kinks is not too great.

If this be so, and if confirmation be obtained by X-rays and bismuth, some surgical means must be adopted to correct the faulty drainage and its results.

Let us now consider the treatment of chronic intestinal stasis in which there is an imperfect ileal effluent associated with recurrent obstruction of the duodenum, and possibly ulceration of its first portion. This condition can be treated by putting the patient in the supine posture for a time. In this posture the obstruction at the end of the ileum is no longer effective, and the kinking at the duodeno-jejunal junction no longer exists. The duodenal tension is relieved, and the ulcer, should it exist, heals. The patient feels very well for a time. On returning to the usual habits of life the obstructions recur and their consequences reappear. Or the patient may be operated on and a gastro-enterostomy performed. During the period the patient is in bed the ileal obstruction is in abeyance and the sufferer is no longer poisoned by absorption. The duodenum recovers itself and an ulcer, if present, heals. The patient resumes the ordinary habits of life, but has no recurrence of the duodenal pain and improves in health. But the symptoms of autointoxication still exist, and increase steadily as the termination of the ileum becomes more and more obstructed. It is quite possible at the time of the operation that the mechanical factor controlling the end of the ileum, whether appendix or acquired ligament, can be dealt with effectually and further operative treatment obviated. When the obstruction results solely from the mechanical control of the appendix, its removal frees the effluent of the ileum and the result is most satisfactory and lasting. If, however, an ileal kink has developed, consequent on the crystallization of lines of resistance in the mesentery, the treatment is not so simple.

When I first observed the kink as produced by the acquired ligament, I devised many

means for its division and for covering over the raw surface thus exposed, and I employed various methods of fixing the ileum in order to avoid recurrence of the kink. I soon, however, had several very unpleasant surprises in the more severe cases. I found that the freeing of the intestine occasionally resulted in an acute obstruction, the freed portion of ileum refusing to transmit its contents. I also found that even when the membrane had been divided and the patient had recovered from the operation, the toxic symptoms returned when active life was resumed. This, of course, did not occur in every case, but in the more advanced cases it did so much too often to be pleasant. Therefore, after a much extended experience and especially when bismuth and X rays showed that there was associated with the ileal obstruction a marked degree of stasis in the large bowel, I have been in the habit of leaving the ileal kink alone and anastomosing the divided end

of the ileum with the pelvic colon immediately below the last kink, and exaggerating the pelvic kink if I did not consider it sufficiently effective.

Again, when I find the large bowel very static, and especially if the abdomen is lax, I remove the colon without the slightest hesitation, since I feel that the risk of its removal in these circumstances is very small indeed, while the benefit the patient obtains from its removal is very great.

If I feel its removal entails any grave risk to the patient, I am satisfied to short-circuit and to postpone the removal of the colon until the patient, freed in great part from autointoxication, complains greatly of the flatulent distention of the large bowel.

It is of course obvious that the nature of the operative interference in any case must vary with the precise alteration in the mechanics of the drainage scheme and with the condition of the patient.

## BIBLIOGRAPHY OF CHYLOUS CYSTS OF THE MESENTERY

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THE following are from notes made for a paper on chylous cysts presented to the American Gastro-Enterologic Association at its St. Louis meeting in June, 1910. This paper was prompted by a study of the medical and pathologic features of the case of Dr. C. E. Congdon and by a doubtful case seen with Dr. A. W. Hengerer, which did not come to section. In the July, 1912, issue of SURGERY, GYNECOLOGY AND OBSTETRICS, Dr. Emanuel Friend of Chicago reports an interesting case and tabulates 52 cases from the literature. To a large degree our series coincide, we employed the same method of tabulation, and to save space it is my intention simply to supplement Friend's list.

The following cases of Friend's list are not included in mine:

Case No. 22. Quinson.

Cases Nos. 29 and 30. Eve. These, from the notes I obtained, seemed to be not strictly chylous cysts.

Case No. 32. Benecke, unless this is one of my unidentified cases mentioned generally by L. Napoleon Boston in his article on chylous ascites in the *J. Am. M. Ass.*, 1905, but the two do not correspond in many details, notably recovery or death.

Case No. 36. Anifrejew.

Case No. 37. Ritter.

Case No. 38. Smoler.

Case No. 40. Panas.

Case No. 41. Peau, unless this refers to one of Pean's cases.

Case No. 42. St. Thomas Hospital Reports.

Case No. 45. Evans.

Cases Nos. 46 and 47. Brinsmade. These I excluded as probably mere degenerations of lymph glands.

- Case No. 49. Icefrazee.  
 Case No. 50. Burrows.  
 Case No. 51. Shattock.  
 Case No. 52. Key and Wilkinson.  
 Case No. 53. Friend's own case, the last five being published too late for my report

The following discrepancies are worth noting. No. 12 of Friend's list, No. 33 of mine (my numbers not being in chronologic order) is attributed to Schlein by Friend, to Lohlein by me; the age is stated as 27 and 57 respectively; I have the size as that of a man's head and the operation as marsupialization. No. 19 of Friend's list, No. 38 of mine, is given by Friend as a multilocular cyst, all compartments containing chyle. According to my notes, there were three compartments, each of about a liter; one was serous, two were chylous. No. 22 of Friend's list, No. 40 of mine, is ascribed to Wenning. This is a misprint, the name being Weining. This was a unique case, evidently of acute nature, about fifty very thin walled cysts being found, of various sizes, from that of a fatal head to an orange, rupturing on the merest touch. At necropsy, the thoracic duct could not be found. In No. 23 of Friend's list, No. 45 of mine, the name should be Hoover, not Hoyer. In No. 26 of Friend's list, No. 16 of mine, the name should be Syms, instead of Lynes. In No. 20 of Friend's list, No. 8 of mine, the name should be Enzmann, not Epymann. There are other minor discrepancies scarcely worth noting.

The following cases are reported in addition. The earlier ones are of especial interest, as they antedate the first formal description by Rokitsansky in 1842, who is, as Dr. Friend states, usually regarded as the first to call attention to the condition. In justice to the early reporters it should be said that their descriptions clearly indicate that they understood the nature of their cases. Indeed, the literature of the 17th and 18th centuries is richer in allusions to lesions of the lymphatics than modern writings, and the profession generally seems to have had more erudition on the subject than we have, although they "knew some things that were not so."

It will be noted that my list of 79, and Friend's of 53, total 96 cases, though, as

stated, the two cases each of Eve and Brinsmade, I had excluded as probably not genuine chylous cysts but rather local degenerative changes in lymph glands. However, it is quite likely that other cases, especially of small size, are of like nature. From various cumulative reports, and vague references to literature inaccessible to me, it appears that there are quite a number of other cases recorded. It is probable, also, that anyone who has gone into ancient medical literature more thoroughly than myself, will recognize several others. Lack of detail, in several instances, is due to my inability to consult the original references and it is possible, on this account, that certain cases may have been duplicated or assigned to secondary reporters. The identity of the mysterious W (4th on my list, which follows Carsons' numbering for the twenty cases that he gathered, and 7th on Friend's list) ought to be known to the Germans.

With the exception of the early cases, preceding Rokitsansky's, most of the reporters or their students are still living and, with this inevitably incomplete and inaccurate bibliography as a basis, it ought to be possible, by co-operation of national institutions of research, to secure a very full list of cases, with most of the important details. A bureau of record for rare cases certainly should be established, not merely for the sake of numeric completeness but because such a bureau could very early determine the proper form in which to list the salient features of any given condition under study. It is likely that about 200 cases could be accumulated in the world's literature.

It is not my present intention to discuss these cases in detail but I wish to emphasize the surprisingly favorable prognosis, especially when one considers that the recoveries have been the result of necessarily inexperienced workers, dealing with cases which had been properly diagnosed in only two or three instances. It is worth while also to correct a false impression. Senator has been repeatedly quoted as stating that true chylous effusions invariably contain sugar. What he really said was that, excluding diabetic cases, sugar was rather characteristic of true chylous



## REPORTED CASES OF CHYLOUS CYSTS OF THE MESENTERY

Frerick's number	Supplementary to Frerick's No.	Reporter	Where reported	Sex and Age	Operation.	Size	Result.	Remarks.
0	54	Rokitansky	Lehrb. d. path. Anat.	M 53	Necropsy		Death	
12	55	Eppinger	Prager Vrtlschr.		Necropsy		Death	Reported as dermoid. Worth revised diagnosis.
23	56	Pencey Jr. July 2 1860	Busey	F ? young	Necropsy*	Large	Death	Chylous ascites tapped several times. Bag of milky liquid at beginning of jejunum
23	57	Le Meray 1710	Southwall's Tr. Roy Acad Sci Paris 1754	F 45	Necropsy	Very large	Death	Nun. Large pendant umbilical hernia for years. Cakareous and soapy deposits besides chyle, 3 loculi
23	58	Morand 1720	Ibid.	M ? (young adult)	Necropsy	1 1/2 lbs.	Death	
24	59	Truman Abell 1825-33	Boston M. & S. J. 1833 vol vii	F 40	Drainage after spontaneous rupture	25 lbs.	Recovery	Also chylous ascites.
25	60	Hughes 1841	Guy's Hosp. Rep. 1841 p. 207	M 30	Necropsy		Death	Multiple cysts and chylous ascites.
26	61	Ducasse 1846	Bull. d. l. Soc. Anat. d. Paris, 1846	Not stated	Not stated		?	Multilocular some containing yellow serous, others white milky fluid.
26	62	M. Hard and Taliaux	Bull. d. l. Acad. d. Med. Aug. 27 1850	M 31	Resection	500 cc	Recovery	
26	63	Pean	Clinique Chir. 1851 53 p. 1318	F 50	Resection after aspiration	12 liters	Recovery	Called cystomycosis and contents pus, but no serous multiple
30	64	Nakerson	Mam. M. Soc. 1854	M 35	Tapping after rupture by hard work	2 qts.	Recovery	No urea, large amount of fat and albumin.
31	65	Hahn	Berl. M. J. June 15 1857	F 8	Resection	Hem's egg	Recovery	
31	66	Kubenska	Zentralbl.	F 40	Enucleation	Fist	Recovery	
35	67	Rodriguez	Bull. d. l. Soc. Anat. d. Paris, 1861	Not stated	Not stated			
36	68	Freudenthal	Bull. Med. 1867	Not stated	Marsupialization		Recovery	
39	69	S. Smith	Quoted by Weising	— 8	Excision		Recovery	Death later from disseminated tuberculosis, which caused blocking of lymph channels.
41	70	Frank	Wien Klin.	F 31	Extirpation*	Adult head	Recovery	Cholesterol, fat globules and a few lecithocytes.
41	71	Oder	Lect. on Diag. of Abdominal Tumors 1864 p. 173	M 44	Necropsy (intestinal strangulation)	Man's head	Death	Observed 3 years. Tapped repeatedly about 2 to 5 1/2 gals. each time at first dark and bloody then creamy. Urt only originally chylous ascites but abdomen dry at necropsy
44	72	Giordano	Clin. Chir. Milano 1865	Not stated	No details			
45	73	Fagensteecher	Berl. Klin. Wchnschr. 1865	M 71	Marsupialization (opened after 6 days)		Recovery	Color of faces but no communication with bowel
45	74	Martin	Verhandl. d. Gesellsch. f. Geburtsh. u. Gynäk. 1866 str. 21	Not stated	No details			
49	75	Rosenheim	Verhandl. d. Ver. f. an. n. Med., Berlin, 1867	? (child)	Necropsy, volvulus	Each size of fist	Death	

\* Winwarter's and three other cases of cyst complicating chylous ascites are mentioned by L. N. Boston (loc. cit.) These three could not be identified, and Boston did not preserve his notes.

\* Location: ileo-jejunal limit

## REPORTED CASES OF CHYLOUS CYSTS OF THE MESENTERY—Continued

Benedict's number	Supplementary to Friend's No	Reporter	Where reported	Sex and Age	Operation	Size	Result	Remarks
54	76	Sarag	Zentralbl f Gynäk 1898, No 16	F 11	Resection pedicle tied and cauterized	5 liters	Recovery	
55	77	Brun (Lettalle)	Presse méd July 20 1899	F 7	Excision	375 cc	Not stated	
56	78	Castaing	Toulouse-méd 1901 5 III 4447	Not stated	Extirpation		Recovery	
57	79	Treiberg	Larop Roussk Clin 1901	Not stated	No details			
59	80	Scharlemmer	Deutsche med Wchnschr Am M Dec. 18, 1902 p 163	M 53	No details	Child's head	Recovery	No connection with lymphatic glands or pancreas could be determined at operation retroperitoneal
60	81	Schmidt	Mitt d Gesellsch f innere Med u Kindes heil Vienna, 1904	Not stated	No details			
63	82	Demons	Quoted by Pfaff	Not stated	Marsupialization		Recovery	Two loculi, one contained blood the other chyle
64	83	Pfaff	Lancet Clinic June 24, 1905	F 15	Enucleation	Orange	Recovery	Blood and urine negative
66	84 <sup>1</sup>			M (child)	Cœlotomy		Recovery	
67	85 <sup>1</sup>			F 5 mos	Tapping		Recovery	Several cysts.
68	86 <sup>1</sup>			M 5 wks	Aspiration		Recovery	
69	87	Stark	Lancet Clinic, 1907	F 56	Not stated		Recovery	Three loculi, 2 bloody, all oily crowding intestines into supra umbilical hernia, 2 calcium carbonate calculi in cyst
71	88	R Hints	Arch f klin Chir, 1910, xci, No 3	F 22	Enucleation	Fist 300 cc	Death	No apparent cause for death unless morphin-scopolamin-chloroform Origin ileo-jejunal junction
78	89	R Hints	Ibid	M 36	Resection after tapping	600 cc.	Recovery	
72	90	C F P Horst	Verbal report, June 1910	F 66	Evacuation (cysts ignored) <sup>2</sup>	Rice pea hazel nut, double fist	Recovery	Two or three hundred cysts, with 3½ gals chyloous ascites
73	91	von Bergmann	Langenbeck's Arch 1887 p 201	Not stated	No details			
74	92	Reichel	München med Wchnschr, 1907, p 808	M 6	Resection of large cyst	Pea walnut man's head	Recovery	Very many cysts
75	93	E C Stahl	Quoted by Eve Med Chir Trans, 1898 lxxxi	M 6	Resection	2 in in diam	Recovery	Unique location, on outer surface of small intestine, opposite mesenteric attachment
76	94	Zdarek	Zeitschr f Heilk 1906	Not stated	No details			
77	95	Wuster and Eker	Brun's Beitr z klin Chir	M 13	Marsupialization	800 cc	Recovery	Retroperitoneal
79	96	Paul Klemm	Arch f path Anat u Physiol	M 235	Resection of cyst and compressed drum after tapping	Child's head	Recovery	Multilocular

<sup>1</sup> First 20 of Benedict's series taken from Carsons, whose case is No 15 of Friend's list<sup>2</sup> For occlusion and dilatation of lymph channels<sup>3</sup> Operation one foot above ileo-caecal valve

effusions. It is obvious that sugar need not necessarily be present.

The following statistics of the whole series of 96 cases may be of interest.

Sex incidence: Males, 39, females 37, not stated 20, hence no sex predilection.

Age incidence at necropsy or operation: Under 1 year, 5; 1 to 5 years, 6; 6 to 10 years, 9; 11 to 15 years, 4; 15 to 20 years, 7; 21 to 30 years, 15; 31 to 40 years, 12; 41 to 50 years, 6; 51 to 60 years, 8; 61 to 70 years, 3; 71 to 80 years, 3, not stated, 18, but, of these last, 2 were children, one a young adult and one was "young." With due allowance for accidental variations among rare cases, long duration of many cases and distribution of population as to age, it can not be stated that any age is especially predisposed.

*Prognosis.* Sixty cases recovered, 14 died after operation, 12 were diagnosed at necropsy, sometimes after many years duration, sometimes after death due to other cause; in 10 cases the result was not stated. Hence the prognosis is surprisingly good.

*Nature of operation.* Aspiration, mainly in early cases, 5; drainage, mainly after preliminary incision, occasionally after spontaneous rupture, 24; some form of enucleation or resection, 31; marsupialization, 4. In a few cases the cyst seems to have been ignored and, in cases of multiple cysts, the small ones were merely ruptured or ignored. In several cases, the nature of the operation is vaguely stated. It does not appear that the result depended upon the choice of operation but upon essential features of the case or the superior advantages of modern surgery, especially with regard to asepsis, although some of the early cases recovered in spite of the absence of such precautions. While all the marsupialized cases recovered, the deaths after extirpation or enucleation seem to have been due to primitive methods, intestinal occlusion, peritonitis, et cetera, and not to choice of method, and, indeed, some of those not stated to have been marsupialized may have been two-step operations.

## THE VALUE OF COMPLETE PHYSIOLOGICAL REST OF THE LARGE BOWEL IN THE TREATMENT OF CERTAIN ULCERATIVE AND OBSTRUCTIVE LESIONS OF THIS ORGAN<sup>1</sup>

WITH DESCRIPTION OF OPERATIVE TECHNIQUE AND REPORT OF CASES

By JOHN YOUNG BROWN, M. D., ST. LOUIS

THE value of rest in the treatment of inflamed and infected abdominal viscera has long been recognized. The opium treatment of peritonitis as advocated by Alonzo Clark, which has long since been abandoned, and the more recent so called starvation treatment of Ochsner, have for their purpose the arrest of intestinal peristalsis, thereby bringing about bowel tranquilization. Complete physiological rest of certain portions of the large bowel, usually the rectum and lower sigmoid, as accomplished by means of left side colostomy, is of well-known worth, both as a life-saving procedure

in acute and late obstructions and as a protective measure in cases where subsequent radical work is contemplated.

The various short-circuiting and exclusion operations upon the gastro-intestinal tract are of undoubted value in selected cases. It is my purpose to point out in this paper the advantages of complete physiological rest of the entire large bowel in the treatment of certain diseases of this organ, which have heretofore been treated by some of the surgical methods above mentioned, and to describe a technique by which this rest can be accomplished, and when its purpose has been ful-

<sup>1</sup> Read before the Southern Surgical and Gynecological Association, December 17, 1911

filled, the bowel can be put back into commission in a manner both safe and satisfactory.

One of the principles on which modern intestinal surgery is based, and which has been responsible for its wonderful progress and marvelous accomplishments, is the principle of rest. Take, for instance, some cases of stricture of the œsophagus. Who has not seen some of these relax following the rest afforded by a gastrostomy? In gastric and duodenal ulcer an abundant clinical evidence has demonstrated the value of the partial rest given to the pylorus and duodenum by gastroenterostomy. The type of cases in which we have found this surgical rest treatment of value may be enumerated as follows:

1. Mucous colitis associated with obstructive lesions
2. Ulcerative colitis (amœbic, bacillary, tuberculous, etc.)
3. Obstructions to the colon, both acute and chronic, due to neoplasms

#### MUCOUS COLITIS

It has been our experience that in the majority of the cases of mucous colitis both the symptoms and X-ray findings show marked evidence of interference with the normal fecal flow, with the accompanying toxæmia invariably associated with chronic intestinal stasis. At operation the cæcum is generally found in the pelvis, dilated and surrounded by well defined membrane. Angulations are found at the hepatic and splenic flexures, with the transverse colon sagging almost to the pelvic brim, even with the patient in the Trendelenburg posture. Many of these cases receive marked temporary benefit from the Weir Mitchell and other medical treatment, associated with posture and properly adjusted orthopedic appliances. It is in this type of case that Lane has advocated the removal of the entire large bowel down to the sigmoid. Finding this operation too radical, he later has practiced the short-circuiting exclusion operation.

Coffey, a fellow of this association, has recently published an able and beautifully illustrated paper in which he describes an

elaborate fixation and hammock-swinging procedure for the correction of the deformities of these unfortunates. While I have obtained some brilliant results from the operation of Lane, I have had however, a number of cases in which most distressing post-operative symptoms have developed, for the relief of which secondary operations became necessary. I have never undertaken the suspension operation of Coffey, as my experience with similar fixation operations in the past has been far from satisfactory.

The technique which I will shortly describe seems, from my comparatively limited experience to meet indications better in the cases under discussion than either of the methods above mentioned. By it all pericolic bands and adhesions can be severed, the cæcum elevated from the pelvis, and the intestinal stasis immediately relieved. The entire colon can be put at rest and during this process of complete physiological rest the patient can be given the benefits which follow dietetic, hygienic and orthopedic treatment, thus giving the bowel a chance to regain its normal tone.

#### ULCERATIVE COLITIS (AMŒBIC, BACILLARY, TUBERCULOUS, ETC.)

While many of the ulcerative types of colitis respond to medical treatment and colonic lavage, the severer types are now recognized as surgical. In the operative treatment of such cases three procedures have been resorted to. First, appendicostomy, second, cæcostomy, third, ileosigmoidostomy. All of these operations are objectionable. The first two simply permit of colonic irrigation and medication. As fast as the colon is flushed with solutions it refills with the fecal contents from the small bowel, thus the area under treatment is constantly contaminated. A very serious objection to the short-circuiting operation is that the lower pelvic colon is almost invariably involved in the colitis, and it is impossible in the majority of cases to bring a loop of ileum to a part of the sigmoid distal to the disease; hence, when this is done, some degree of the symptoms, namely, that due to the sigmoid below anastomosis, will persist.

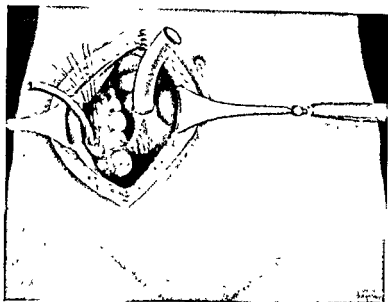


Fig. 1. Showing tube and purse string in proximal portion of ileum. Stump where appendix was removed and stump of inverted distal ileum. Also catheter and purse-string in sigmoid showing fixation sutures.

#### OBSTRUCTIONS TO THE COLON (BOTH ACUTE AND CHRONIC) DUE TO NEOPLASMS

The advantage of the operation suggested by the writer will readily be seen when it is applied to the treatment of acute and chronic obstructions of the sigmoid and rectum. It possesses all the advantages of the left-side procedure with none of the disadvantages. It permits a drainage of the distended small intestine as well as rest and irrigation of the large intestine. In those cases of low bowel obstruction in which the diagnosis is in doubt, it should be the operation of choice. A left-side artificial anus is easily made but we all appreciate the difficulty of closing it. If the obstruction is due to an inoperable malignancy the left-side anus possesses no advantages over the right-side method. If the diagnosis is wrong and the growth is a benign one, it will readily be seen that the left-side operation should not be undertaken, for the reason that its closure is both difficult and dangerous and will greatly interfere with the subsequent surgical treatment, namely, the closure of the artificial anus. Another advantage of the right-side anus is the relief afforded the patient when constantly inhal-

ing the horrible stench that is the invariable accompaniment of the left-side operation. The contents of the small bowel possess only a slight odor and, contrary to former teachings, there is no irritation of the skin. On the contrary, when the operation is done on the left side, the stagnating and filthy fecal flow from the colon brings about a condition almost unbearable.

#### OPERATIVE TECHNIQUE

Through a right rectus incision sufficiently long for general exploratory purposes the abdomen is opened. The cecum is at once sought and the large bowel is carefully examined from cecum to sigmoid. All pericolic adhesions are then severed, the appendix removed and the stump buried. The ileum is next severed between two clamps close to the ileo-caecal valve. The distal ileum is tied off and buried as was the appendix. At a suitable part of the caecum a purse-string suture of linen is placed, and the caecum is next incised. Through this incision a large rubber catheter is inserted after which the purse string is tightly tied. A second purse-string of No. 1 chromic catgut is next placed. Under the loops of this purse-string, three long catgut fixation sutures are placed (Fig. 1). A stab wound is next made at McBurney's point, through which a forceps is inserted. The catheter and fixation sutures are grasped in the bite of this forceps and pulled through the stab-wound. The peritoneal

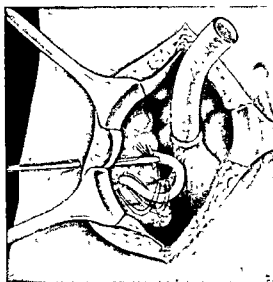


Fig 2 Method of making stab wound. The forceps shown grasping the catheter and fixation sutures

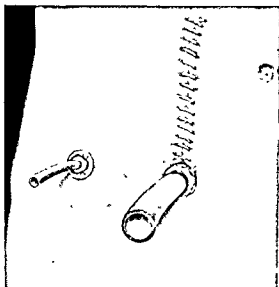


Fig 3 Showing catheter and button in place with fixation sutures tied. Artificial anus with tube in proximal portion of ileum. Wound closed

surfaces surrounding the catheter are next scarified and the catheter is pulled through the stab-wound, carrying with it the three fixation sutures. The catheter is now slipped through the button, and the fixation sutures are threaded through the eyes in the button and tightly tied, thus closely approximating the serous surfaces of the cæcum to the parietal peritoneum (Fig 2). A stiff rubber drainage tube is next inserted into the proximal ileum and fixed with a double purse-string suture. The ileum is now brought out of the lower angle of the rectus incision. The parietal peritoneum is made to hug it snugly by a few catgut sutures, and the abdominal wound is closed in the usual way (Fig 3). Indications for restoring the continuity of the large bowel are improvement of the general condition and the return to normal of the discharge from the excluded large bowel as shown after repeated chemical, microscopic or culture-growth examination of irrigation fluids passed through it depending upon the lesion present. This restoration should not be made too early, particularly in the ulcerative lesions of the colon. When the surgeon deems that the large bowel has sufficiently healed and desires to put this organ back into commission this restoration is readily done by simply cutting out the anus at the lower angle of the rectus incision, closing its end with a purse-string suture, and making a lateral anastomosis of ileum to ascending colon, or switching the ileum into the sigmoid. We have never

found any difficulty in restoring intestinal continuity, on the contrary the operation is simple and easy.

#### REPORT OF CASES

This report is based upon the experience we have gained from ten cases so operated. Two were cases of chronic intestinal stasis, with obstructions due to pericolic bands and flexures. Both have greatly improved and are now comparatively well. Three operations were done for the relief of amebic dysentery. All were cured. One for ulcerative colitis with extensive involvement of sigmoid and rectum. This patient is now in good health. One case for extensive obstructive tubercular colitis. This patient received great relief from the operation and lived in comfort for two months. Three were for late and inoperable malignancies of the rectum. One lived six months, one five months, and the third case, still living, nine months after operation, is comfortable, and is in reasonably good health; so it will be seen that there was no mortality in the series.

# THE FIRST SUCCESSFUL CASE OF RESECTION OF THE THORACIC PORTION OF THE OESOPHAGUS FOR CARCINOMA<sup>1</sup>

By FRANZ TOREK, A M, M D, NEW YORK CITY

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THE resection of the thoracic portion of the oesophagus for carcinoma has been one of the greatest problems of modern surgery. It is not the object of this paper to give the history of oesophageal surgery, much less could I mention the notable achievements of any one surgeon without injustice to others not named. But I must call attention to the view expressed by one of the most competent representatives of this branch of surgery, not only because it exerted a far-reaching influence on the efforts of others, but especially because my case does not substantiate this view. I refer to the standpoint of Sauerbruch that operations for carcinoma of the oesophagus should be undertaken only if the new growth is either high up near the neck or low down, where an anastomosis with the stomach could be made, but that the growths in the middle portion of the oesophagus are not removable. The reasons for excluding these cases from the realm of operative interference were, first, the inaccessibility of that portion of the oesophagus which passes behind the arch of the aorta, and secondly the danger arising from injury to the pneumogastric nerves, which in that location branch in front of the oesophagus like a plexus. Division of both vagi at a place before they reach the heart causes instant death, and at operations in that region it has been repeatedly observed that tugging at a vagus, or pinching it, was promptly followed by collapse of the heart, as manifested by the pulse, which persisted for a longer or shorter time, until death set in. Finally, the uncertainty of the closure of the upper stump of the oesophagus, and consequent infection of the pleural cavity, has been a source of great danger after resection in any part of the oesophagus where an anastomosis could not be made. The leakage

from that stump was doubtless due to the tension in the oesophagus from swallowed saliva. Every contraction of the constrictors of the pharynx would temporarily increase the tension in this blind pouch, until the suture finally was unable to withstand the pressure from within. The patients who had escaped death either from injury to the vagus or from shock, pneumothorax, or pneumonia, all died from the giving way of the oesophageal closure, no matter how skillful the operating surgeon had been.

Statistics show that carcinoma of the oesophagus is most frequently found in the middle third, the location in the lower third coming next, while those in the upper third are comparatively rare. On the other hand, metastases are found most frequently with those situated in the lower third, near the cardia. Since, therefore, the carcinomata at the cardia are not only numerically less frequent than those in the middle third, but are also more frequently associated with metastases that render the cases incurable, the most important rôle in the problem of cancer of the oesophagus seems to belong to the carcinomata in the middle portion, the very ones that Sauerbruch and others advised leaving untouched.

In a case operated at the German Hospital on March 14, 1913, I succeeded in demonstrating the feasibility of resection of the middle portion of the oesophagus for carcinoma. The patient, a woman 67 years old, had a carcinoma of the oesophagus beginning just below the lower border of the transverse portion of the arch of the aorta and extending from there downward for about 1¾ inches. A pair of very beautiful stereoscopic X ray pictures taken by Dr. William H. Stewart demonstrated the condition before the operation. A reproduction of one of these is seen in Fig. 1. I had performed a gastrostomy upon her some time previous to the resection of the oesophagus. Knowing the difficulties of the case, the problem was to plan the ways

<sup>1</sup> Read before the New York County Medical Society, March 24, 1913; the Harlem Medical Association, April 2, 1913; the Surgical Section of the New York Academy of Medicine, April 4, 1913; and the German Medical Society of New York, April 7, 1913.



Fig 1 The bismuth shadow shows where the construction of the oesophagus begins

and means of overcoming them. It was necessary, first, to afford better access; secondly to perform more careful dissection of the vagi avoiding rough handling of them, and thirdly, to do away with the danger of leakage from the proximal stump after resection.

The method of access to the field of operation was as follows. Instead of going through two different intercostal spaces and dissecting off the scapula or of resecting several adjacent ribs as recommended by others, the incision was carried through the whole length of the seventh intercostal space from the posterior end of which it was extended upward by cutting through the seventh, sixth, fifth and fourth ribs near their tubercles which gave a much better exposure and is far simpler. The photograph (Fig 2) shows the scar from the incision, the upper end of which is almost at the level of the shoulder; the front end of the incision is seen in Fig 3. The black line accompanying it is a marking with nitrate of silver made on the day before the operation.

Extensive adhesions between the lung and the parietal pleura were present, the greater part of the lower lobe being attached both to the costal and the diaphragmatic pleura. The firmest adhesions were at the apex. All these were separated. The tumor was found to be fairly fixed in the position above



Fig 2 Photograph taken 12 days after the operation. The black line accompanying the incision is a nitrate of silver marking made the day before the operation. The upper end of the incision is almost at the level of the shoulder. The anterior end of the incision is seen in Fig 3.

described viz just below the lower border of the transverse portion of the arch of the aorta, allowing only very slight mobility. The portion of the oesophagus below the tumor between it and the diaphragm was exposed in the usual manner by incising the pleura, drawing the vagi aside and lifting the oesophagus out of its bed. At the site of the tumor the dissection of the vagi was more difficult, and some of the branches crossing over in front of it had to be cut in order to permit liberating the tumor without undue roughness in handling the vagi. To my great satisfaction the pulse never wavered during this procedure, remaining between 93 and 96. The dreaded vagus collapse had, therefore, been safely avoided.

The dissection of that part of the oesophagus which passes behind the arch of the aorta offered great difficulties, which were finally overcome by dislodging the aorta at that site and lifting it forward, after having ligated and divided a number of its thoracic branches. Getting the aorta out of the way, where it crosses the oesophagus, is of considerable help in liberating the latter, in simple cases, however, I feel certain that the dissection could be





Fig 3 Photograph taken 12 days after operation. The incision at the anterior border of the left sterno-cleido-mastoid muscle, through which the œsophagus was taken out is scarcely recognizable. The œsophagus has been placed under the skin of the chest and its end sutured to an incision in the skin. The gastrostomy tube is introduced into the œsophagus whenever the patient desires to swallow.

done without ligating the thoracic branches of the aorta. The tumor was attached to the left bronchus, which sustained a longitudinal cut during the progress of the separation of the tumor from it. The cut in the bronchus was afterward sutured with silk.

The œsophagus had now been detached from its bed, beginning at a point about an inch above the diaphragm, up to about an inch above the arch of the aorta. The resection of the carcinoma *in situ* could therefore have been easily performed. But my plan was different. I had come to the conclusion that the rational way to deal with the danger of leakage from the upper stump of the œsophagus was to eliminate that organ from the pleural cavity altogether. I therefore dissected the œsophagus loose from its attachments all the way up to the neck, divided it with a cautery at a safe distance below the carcinoma, after double ligation, and brought the œsophagus with the tumor out through an incision in the neck at the anterior border of the

left sterno cleido-mastoid muscle. Thus the pleural cavity could not possibly become infected from that source. The ligation of the lower stump had been made after first crushing the œsophagus at that site. This stump was invaginated like an appendix stump, only with the difference that two successive purse-string sutures of silk were used instead of only one, as in the case of the appendix.

The thorax was now closed, silk threads being used to hold the seventh and eighth ribs together, chromicized catgut for the muscles, and silk worm gut for the skin. No drainage was employed. Now the œsophagus which was hanging out from the wound in the neck was placed under the skin of the chest. For this purpose a transverse incision was made in the skin at a place corresponding to what was going to be the free end of the œsophagus after the carcinoma was cut off, for at the time this was still attached. The site of that incision in this case corresponds to the second intercostal space. The skin between the incision in the neck and the new incision was tunneled, the œsophagus drawn through, the carcinoma cut off, and the fresh rim of the œsophagus sutured to the skin. The neck wound was closed.

As regards other details of the operation, I may say that the incision through the skin and muscles was made under local anesthesia, one half per cent novocain with suprarenin being used. The general anesthesia was given by tracheal insufflation according to Meltzer-Auer, the apparatus constructed by Dr. Hermann Fischer being used. It worked very satisfactorily. The employment of a differential pressure chamber, either positive or negative, could not be considered, as the rubber cuff around the patient's neck used in such an apparatus to separate the air about the head from the air about the body would have interfered with the operation at the neck.

From the notes taken by Dr. Carl Eggers, who administered the anæsthetic, I extract the following: For the induction of anæsthesia, 15 cc of



Fig 4 On the left side a portion of the specimen has been removed for pathological examination.

anæsthol was used. Then intubation was performed, a woven silk catheter, No. 18 French, being introduced with the aid of the finger. The catheter was fastened to the upper lip by a suture, as the patient had no teeth to which to tie it. Ether was used now for anæsthesia, 100 cc. sufficing for the entire operation. The pulse was regular and of good quality throughout the operation except when the aorta was strongly pulled over for the purpose of suturing the cut bronchus. At that time it became weak and rose to 102. Strychnin, caffeine, and camphor were used for stimulation. A hot coffee enema with whisky and strychnin was also given at the end of the operation. The intrathoracic portion of the operation, from the incision of the pleura to the closure of the thoracic cavity took 1 hour and 45 minutes, the whole operation, from the first incision to complete closure, 2 hours and 43 minutes, the general anæsthesia, 2 hours and 27 minutes.

The microscopic examination of the specimen made by Dr. Frederick B. Humphreys proved the new growth to be a squamous celled epithelioma. From his description I quote the following. In the center of the specimen (Fig. 4) there is a ragged indurated ulcer, roughly circular in form, measuring 4.6 cm. across and 4.3 cm. from above down. The ulcer extends over the entire circumference of the mucosa, excepting a small strip about 0.8 cm. in width. The floor of this ulcer is ragged, reddened, and firm, the edges raised and nodular and fairly well circumscribed. The adjacent portions of the oesophageal mucosa show a few small, non-ulcerated, raised nodules, but at the lines of section the mucosa appears entirely free from invasion. The outer surface is rough. The external coat is slightly lacerated, but nowhere has the tumor macroscopically grown through, excepting in one region where there is a nodule about 1 cm. in diameter. Immediately over this nodule is a soft anthracotic lymph node attached to the muscle.

My assistants at the operation were Drs. Frederick H. Dieterich, Martin Bry, and Albert Barge, members of the house staff of the German Hospital. The patient made a good recovery. The stitches were removed, some on the fourth day and the remaining ones on the seventh day, when the wound proved

to be completely closed. The pulse, respiration, and temperature had become normal by the fifth day. The highest point that the temperature had reached was 102° F., on the third day after the operation.

Up to the eighth day after the operation the patient was nourished in the same manner as before the operation, through the gastrostomy tube with a funnel attached. After that time the free end of a gastrostomy tube was introduced into the cut end of the oesophagus for the purpose of feeding the patient (Fig. 3). The rubber tube being of somewhat smaller caliber than the oesophagus, the patient has to make slight pressure upon the skin to one side of the tube to prevent leakage. This is accomplished by the patient without the slightest trouble, and she now swallows all varieties of food that can be chewed into an almost fluid state, such as bread, cereals, potatoes, eggs, spinach, etc. As she had not been able to take any bread for about nine months before her operation, she feels very happy with her rubber oesophagus.

A number of methods of oesophagoplasty have been devised, the most promising of which at the present time seems to be that of Janu, utilizing the greater curvature of the stomach to form an oesophagus. This is placed under the skin of the thorax and in favorable cases may reach up to the end of the divided oesophagus so as to render a union of the two ends possible.

Now that the way for a successful performance of this operation has been shown, it is our evident duty to advise operation as soon as the presence of a carcinoma of the oesophagus is recognized, remembering that success depends to a great degree upon early diagnosis and early operation, and that it is not wise to wait until the difficulty in swallowing becomes marked before our suspicion of the presence of cancer is aroused.

# PROSTATECTOMY; WITH SPECIAL REFERENCE TO THE SEQUELS<sup>1</sup>

By JAMES E. MOORE, M D, MINNEAPOLIS, MINNESOTA

**W**HEN we first began to perform prostatectomies we usually did the suprapubic operation, and only removed the projecting portion of the prostate. The operation was blind, bloody, and unsatisfactory, and the mortality rate was high. The immediate results were sometimes satisfactory, but a return of the obstruction was not uncommon. Under these conditions the operation was not a popular one. The present popularity of prostatectomy began with the development of the perineal operation, which was a complete operation, was followed by better and permanent results, and was accompanied by a lower mortality rate. For a time this operation was very popular, and the journals were filled with reports of successful results. Had the unsuccessful results been as faithfully reported, the operation never would have become so popular. At the present time perineal prostatectomy, in capable hands and in properly selected cases, is a life-saving and conservative operation, and is the first choice of many of our best surgeons.

After the advantages of a complete enucleation of the gland had been demonstrated by the perineal operation, it was found that the

gland could be readily enucleated through the suprapubic opening, and it is now the most popular operation. Even after the upper operation had become quite popular its mortality rate was considerably higher than that of the lower operation. At the present time the mortality rate of the two operations is practically the same, and is naturally lower than it was during the period of development. I was an early and enthusiastic advocate of the lower operation, but as time has gone by and as the technique of the upper operation has become developed I have found myself resorting more and more frequently to the latter operation, and this has been the general trend of surgeons. No surgeon should be wedded to one operation, but should be proficient in both, so that he can fit the operation to the patient and not the patient to the operation. The popularity of the upper operation is largely due to the fact that it is the easier operation to perform. Its enthusiastic advocates claim that there are fewer complications and sequels, and that convalescence is shorter and more satisfactory, but these are still moot points.

When the possibilities of complete prostatectomy were realized the operation was soon being overdone by many surgeons — and was undertaken by many would-be surgeons. The reaction was natural and wholesome, so that now expert operators are more conservative and novices have learned that it is not a good operation to experiment with. A few years ago one enthusiast said that the operation was so simple and easy that it should be relegated to minor surgery, but I am sure that all my hearers will agree with me that it is a serious major operation, and that it should not be undertaken lightly by the experienced surgeon, and should never be undertaken by the occasional operator.

It would be a waste of your valuable time to describe the technique of these operations, because it has been so often and so well written, but there is one practical point in the



Fig. 1

<sup>1</sup>Read before the Southern Surgical and Gynecological Society, December 19, 1912

technique of the upper operation which I have practiced and taught to my students for a number of years, and to which I wish to call your attention. Most writers recommend that after the suprapubic opening is completed and the operator is ready to attack the gland, he begin by cutting or tearing through the mucous membrane of the base of the bladder over the most prominent part of the enlargement. I have found it much easier and quicker to force the point of the index finger into the internal meatus until the mucous lining breaks, when the finger can be readily passed through this break and the gland enucleated. In this way the gland can be enucleated nearly as quickly as the cut could be located and made in the mucous membrane, and with much less hæmorrhage. I can heartily recommend this little maneuver. It was original with me, but others have also discovered it. Dr L. L. McArthur, of Chicago, published the first description of it.

The general practitioner should be interested in prostatectomy, and should be familiar with its possibilities and its indications and contraindications, for it is usually to him that the patient first goes for relief. Conservatism should be the watchword in these cases, but it is not conservatism to postpone operation until organic changes have taken place in the bladder and kidneys. Every general practitioner should fully realize that when he is called to relieve a patient from retention of urine due to an enlarged prostate he is facing a grave responsibility. Up to this time the patient may have had little or no suffering, but will only have been inconvenienced by being obliged to get up at night to urinate. If the bladder is emptied aseptically at this time, the patient may go on indefinitely without serious trouble, but should the doctor, through carelessness or by use of a dirty catheter, infect this bladder, the patient is immediately in a serious condition, which may end in death in spite of all human agencies.

Prostatectomy is too grave an operation to recommend simply because the patient has an enlarged prostate which is causing him some trouble. An enlarged prostate is very easy to diagnose, and should not be overlooked

by anyone. The general practitioner, when clean and careful, can with propriety resort to an occasional catheterization, but when its repeated use is called for he should take this as a positive indication for prostatectomy. At the present day a patient should never be introduced into catheter life without first having had the advantages of prostatectomy urged upon him, for the average length of catheter life is not over four years, and if every patient were to have a prostatectomy performed when he begins to have serious trouble, the average length of life would be very much longer than this.

Old age is not of itself a contraindication for the operation, because many successful operations have been performed upon patients well up in the eighties. When a patient has not been properly advised, or has refused to accept good advice and has drifted along until there is extensive infection of his bladder, with possibly infected kidneys, he is not a choice subject for prostatectomy; but without operation he will surely be a great sufferer and will live but a short time, so it would be wrong to deny him the benefits of surgery. In such cases suprapubic drainage can be safely established under local anæsthesia, which will afford wonderful relief, and quite frequently the patient will improve so much after this that a prostatectomy may become advisable.

Prostatectomy even in suitable cases is not always satisfactory, because of sequels which make the patient feel that he is little better off than before the operation; and occasionally he is worse after the operation than he was before. Not infrequently a patient who has been operated upon and discharged by the surgeon in a seemingly satisfactory condition comes back to the family doctor suffering from some sequel that makes his life miserable.

When a comparatively young man has trouble enough with his prostate to induce him to consider prostatectomy, the effect it will have upon his sexual powers is a very important question. It is quite customary in reporting results from prostatectomy to state that the sexual function is unimpaired. We know that this is a truthful statement in many

cases, but every observing surgeon knows that there are many cases where this function is either greatly impaired or totally destroyed by the operation. When the ejaculatory ducts are destroyed, as they usually are, the patient is necessarily sterile, which is a matter of comparatively little importance, for most of these patients are sterile before operation, but unfortunately many of them are impotent after prostatectomy. It is difficult to get at the truth in this matter, for the patient considers his condition a disgrace rather than a misfortune, and is not disposed to talk about it. Very naturally, however, he will not recommend the operation to his friends.

The fact that prostatectomy does not always cause impotence proves that the loss of the gland is not the cause of this unfortunate sequel. The destruction of the ejaculatory ducts cannot be the cause, else impotence would be the rule instead of the exception. Until we have learned just what it is that causes impotence after this operation it is impossible to prevent it. It is rational, however, to conclude that, inasmuch as erection is due to a reflex stimulus, the damage must be due to an injury to the nerve supply. When we take into consideration the fact that at best prostatectomy is a rough and rather unsurgical operation, performed upon parts highly organized and with a most delicate and sensitive nerve supply, the marvel is that impotence does not always follow.

Gangrene of the bladder is an occasional sequel. I have had one case of this kind within a year. A suprapubic operation was easily and quickly performed and the patient did very well for four days, when his pulse began to go up, and he soon died. The bowel was not injured, but the whole base of his bladder was gangrenous. The possibility of this sequel should be remembered, and unnecessary bruising and tearing should be avoided. In this way the danger of gangrene will be reduced to the minimum, but the probability is that it will occur occasionally in spite of every precaution.

Every surgeon learns to search the bladder carefully for stone at the time of the operation, because many cases are on record where

stones were left which necessitated a second operation for their removal. There is no doubt but that stones do sometimes form in the bladder after the operation, for which the operator should not be held responsible. Doubtless, fragments of the prostate or clots of blood act as a nucleus around which a stone may form. That they may form quickly I am convinced from the following experience. I performed a suprapubic prostatectomy, removing a very large prostate through a badly infected bladder. Owing to the condition, I thought of the possibility of stone, and explored the bladder most carefully, both with fingers and instruments, and found no stones. The patient had been bedfast for some time before the operation, but made a very rapid convalescence and soon resumed his business, being, as he stated, in perfect health. In much less than a year, but just how many months after the operation I do not know, he came to my office stating that he was having pain and frequent urination. I suspected stone, and advised him to go to the hospital for examination. This suggestion did not seem to meet with his approval, for I did not see him again. Some time afterward I learned that he came under the care of another surgeon, who removed a large stone from his bladder. This surgeon informs me that the patient came to him suffering from an abscess in the abdominal wall at the seat of the scar, and that the presence of the stone was not known until found when the abscess was opened. The stone was a large one, but I am confident that it must have formed after the operation, because I searched so carefully for it at the time of my operation, and because the patient was so thoroughly relieved by the operation.

This skiagraph (Fig. 1) illustrates how stones may be in a pocket so that they escape detection. This patient was operated upon at the University Hospital by one of the staff. The perineal operation was performed and a very large prostate removed. The opening required was so large that it caused the operator some uneasiness, but it afforded ample opportunity to examine the bladder, which was carefully done. The patient, although old and quite feeble, made a prompt

recovery and soon began to void urine naturally. When he was about ready to go home he reported that he had passed two stones through the urethra. The stones resembled medium size gallstones, and were faceted. Before passing the stones he had been perfectly comfortable, but this can be accounted for from the fact that they were closely packed in a pocket. In the original plate this mass is distinctly shown to consist of many stones closely packed together, but this print does not bring this out clearly.

Careful search for stone should be made after every prostatectomy, for they are so often present and they should not be overlooked. A skiagraph should be taken before every operation, which will demonstrate the presence of all stones, whether pocketed or not. Before closing the wound the bladder should be thoroughly emptied of all detritus, and later all blood clots should be removed.

In early cases of prostatism, where the obstruction is not too great and the cystitis not too severe, the cystoscope is very helpful. Stones can be detected, the condition of the mucous membrane ascertained, and the ureters catheterized. In older cases, however, the cystoscope is liable to do more harm than good. The greater enlargement makes the introduction more difficult and painful and elevates the beak of the instrument so that the ureters cannot be seen. Even if they could be exposed, their catheterization through a highly septic bladder is an unwarrantable procedure.

A few years ago urinary fistulae were not an uncommon sequel, but with our present technique this is very rare. A fistula is most likely to occur when the cystitis is so severe that liberal and sometimes protracted drainage is an essential part of the treatment. With a reasonably clean bladder the present trend of surgical technique is toward a more thorough closing of the wound, which shortens the convalescence and reduces the danger of fistula to the minimum.

In some instances, owing to the atony of the bladder before the operation, the patient is still obliged to use the catheter after the obstruction is entirely relieved. He has been greatly benefited, because a large sized cath-

ter can be passed without pain, but he naturally feels that the operation is not a perfect success. It is impossible to remedy this condition. It is wise to inform a patient who has led a catheter life for some time that possibly he may be obliged to continue the same after an operation, but it is safe to promise him that catheterization will be much easier and comparatively painless afterward.

Incontinence or dribbling is an occasional sequel after both operations, and is of course due to injury of the sphincter muscles or their nerve supply. The sphincter at the neck of the bladder is always stretched and more or less injured by the upper operation, and special care should be exercised during this operation not to tear it. In the lower operation the sphincter of the bladder is not in so much danger, but the accelerator urinae muscle about the membranous urethra, which has an important sphincter action, is very liable to injury. To avoid this, entrance into the urethra should be made at the apex of the prostate, through the prostatic urethra. Incontinence is the sequel which makes the patient feel that the operation has done more harm than good. He forgets that he has been relieved from pain and thinks only of his present affliction, which makes him a nuisance to himself and to everyone around him. This is a most distressing sequel, and every precaution should be exercised to prevent it, for it is practically incurable when once established.

In conclusion, the writer wishes to state that he is an optimist and believes that the present day prostatectomy is one of the most beneficial operations at our command; but he feels that the number of failures and sequels are too numerous, and this leads to the question if less radical measures may not be better, such as removing the middle lobe by instrumental means, as suggested by Young, or removing the middle lobe and stretching the prostatic urethra through a suprapubic opening, as practiced by Siter of Philadelphia. Siter's suggestion is surely worthy of consideration, because his large experience has led him to conclude that dilatation is accompanied by practically no complications and sequels, and is followed by most satisfactory results.

NITROUS OXIDE AND OXYGEN ANÆSTHESIA<sup>1</sup>

## OBSERVATIONS IN 2500 CASES

By E. M. PRINCE, M. D., BIRMINGHAM, ALABAMA

THE question of the selection of an anæsthetic continues to be of first importance to the surgeon of to-day who endeavors to give to those seeking his skill the best of everything connected with the art of surgery. All realize that the question of the best anæsthetic in all cases is far from answered. It is only by the comparison of series of cases under one kind of anæsthetic, and only when many thousands have been given, that one can draw any conclusions. Many thousands may be anæsthetized by one anæsthetic agent before we are able to find out its real dangers or advantages.

The post-operative effect on the patient, together with his condition when the anæsthetic was begun, should be taken into consideration. We might have a very high death rate on the table in cases whose condition was exceedingly grave when the anæsthetic was begun, while on the other hand a more dangerous anæsthetic agent might show a decidedly lower mortality if given in cases whose resistance was about normal. It would be very unfair to condemn the anæsthetic, and hold it wholly responsible for the death, unless all conditions were taken into consideration. On the other hand, when a death occurs while the patient is on the operating table, whether the operation is under way or not, unless very conclusive evidence to the contrary can be produced, the anæsthetic should come in for its share of responsibility.

If we are overenthusiastic as to the virtues of one anæsthetic agent, we can oftentimes find some cause other than the anæsthetic for the accident, such as status lymphaticus, etc.

While I would not like to say that the anæsthetic under discussion (nitrous oxide and oxygen) will ever be the anæsthetic of choice for the majority of surgeons—for there are quite a few disadvantages that require time and patience to overcome—

still I believe its administration in 1000 cases in which the resistance had been greatly reduced by disease will show a mortality rate so favorable to this anæsthetic that one would hesitate to use any other.

## SELECTION OF CASES

The very old, the very young, patients who have any cardiac complications, and the very large, robust subjects, are said to be unfit for nitrous oxide and oxygen anæsthesia. The very old are the cases in which this anæsthetic is used to the greatest advantage. Their tendency to lung complications, the usual nephritis in these old people, and the desire to make their post-operative condition as comfortable as possible, render this anæsthetic the ideal one in these cases. The objection advanced by some that "the blood pressure is elevated, making the aged more likely to cerebral apoplexy," will not hold good, as this can be prevented by giving enough oxygen. We can operate on these patients using 8 per cent oxygen, or in the same cases give 12 to 15 per cent, and the patient will sleep as nicely under the latter as the former proportion. They can be gotten out of bed much earlier, as they seldom go through the prolonged stage of nausea and vomiting seen after ether.

Those cases presenting cardiac complications do not show the rise in blood pressure if there is sufficient oxygen given, and would certainly do as well under the gas-oxygen as under ether. We have taken the blood pressure in many of these cases while they were under the anæsthetic and found it varies very little from what it was before the anæsthetic was begun. I have never used nitrous oxide and oxygen in children under three years of age, but I find a child of this age and over does extremely well. The very large, robust subject is as easy to anæsthetize with nitrous oxide oxygen as the smaller. It does

<sup>1</sup>Read before the New York Academy of Medicine November 4, 1912

not seem to require any more of the gas than in the smaller subject to produce surgical anæsthesia. A great deal depends on the individual patient.

#### PREVIOUS HABITS OF THE INDIVIDUAL

The man who has been a constant and hard drinker is a very unfavorable subject for any kind of anæsthetic, although I think he takes the nitrous oxide and oxygen equally as well as he takes ether, provided a preliminary of scopolamin and morphin is given him. In many of these cases we experience no trouble, while in others we have the same struggling seen in almost all of these drinkers when ether is the anæsthetic agent.

The morphin habitué is also a harder subject to anæsthetize with nitrous oxide and oxygen than one who is not addicted to the drug. One with a nervous tendency will take the anæsthetic as easily, but I do not think the pulse will run as smoothly under the anæsthetic as one who is not easily excited.

The dark-skinned race is one that requires the most careful watching on the part of the anæsthetist, because the cyanosis is not so readily seen in these cases, and in the negro it cannot be seen at all. My anæsthetist, Dr. Dawson, informs me he is governed in these cases mainly by the pulse rate and respiration.

In these the average per cent of oxygen is also commenced with and the amount then varied according to the requirements of the individual case.

#### CONDITIONS DEMANDING NITROUS OXIDE-OXYGEN

Cases in which this anæsthetic is especially indicated are those suffering with lung and kidney complications, those in which we have a very low hæmoglobin, and those that are extremely septic. No one who has followed the investigations of such men as Crile, Hamberger, and Ewing, and many others, could think of suggesting any other anæsthetic where we have a grave nephritic complication in a case where surgery is a necessity. There are absolutely no ill effects ever seen following this anæsthetic in these grave cases. In our normal cases we find more urine excreted

during the first 24 hours after nitrous oxide-oxygen than for the same length of time following ether. We never have albumin following the use of this anæsthetic, which is not the case where ether is used. To the tubercular patient, whose lungs are already waging a desperate battle against the invading organism, nitrous oxide-oxygen is certainly a godsend. These patients are not hastily operated upon, but ofttimes we are compelled to resort to surgery, where their already desperate condition is complicated by some other infection more dangerous. The irritating action of ether on the lung tissue in these cases is perhaps just sufficient to turn the tide in favor of the disease. The post-operative pneumonia following ether is never seen where nitrous oxide and oxygen are used. In the very septic cases, and those whose hæmoglobin has been greatly reduced by continuous bleeding, nitrous oxide and oxygen certainly give the patient the better chance of recovery. It has been shown that hæmolysis never follows the use of nitrous oxide and oxygen anæsthesia, nor is the hæmoglobin reduced. This cannot be said to be the case after other forms of anæsthesia. These infected patients are fit subjects for shock, but are rendered less liable to it, as it has been proven that a patient is not so susceptible to shock under this anæsthetic as under any other.

#### PREPARATION OF PATIENT FOR OPERATION

The patients are prepared in the usual manner in most respects, such as cleansing of the bowels, the deprivation of food for 12 hours, and it is best that no water be given to the patients during the hour preceding the operation, as this will render them less likely to regurgitation while on the operating table.

#### PRELIMINARY MEDICATION

The usual preliminary given by me before operation is morphin sulphate gr.  $\frac{3}{8}$  to  $\frac{1}{4}$ , atropin sulphate, gr.  $\frac{1}{100}$ , and strychnin sulphate gr.  $\frac{1}{30}$ . In subjects that have been hard drinkers, scopolamin, gr.  $\frac{1}{200}$  to  $\frac{1}{100}$  will prove an aid to the anæsthetic. In many cases this preliminary medication is unnecessary, and I have given over 300 without using



any preliminary whatever. No morphin should ever be used before operating on children, as it is unnecessary, and as a rule children bear an opiate poorly. I was recently taken severely to task by one who by reputation as an anæsthetist has no superior, and whose good opinion I value most highly, for reporting as nitrous oxide and oxygen anæsthesias those cases in which we had given a preliminary of morphin gr.  $\frac{1}{8}$  to  $\frac{1}{4}$ , he stating that none of these were nitrous oxide and oxygen anæsthesias, but should be classed as morphin, nitrous oxide and oxygen anæsthesias. I do not agree with anyone in this stand as the morphin is not an essential part of the anæsthetic, nor is morphin considered an anæsthetic agent. It is used to render the patient a better subject for its administration, just as we use restriction of food and other measures.

One of the most important functions of the preliminary of morphin is its anodyne effect; as the patient awakens so quickly the pain would be quite severe were it not for this preliminary. In children, camphorated tincture of opium may be given just before operation, and may be continued afterward, as vomiting is so seldom seen in children after this anæsthetic.

#### ADMINISTRATION

No one should be permitted to administer nitrous oxide and oxygen unless he be well trained in the work or is giving it under a suitable instructor. This will never be the routine hospital anæsthetic to be given by the internes. It will always require one who has devoted time and thought to the question of anæsthesia in general, and this form in particular. The surgeon should employ one trained anæsthetist who is permitted to administer every anæsthetic for him, as in this way he will become more efficient in the work.

The trained anæsthetist should be paid as every other specialist in medicine, and the surgeon should not desire the services of a specialist at the price of a day laborer. If this special field of surgery were better appreciated and better paid, we would find more competent men seeking to perfect them-

selves in the art of administering an anæsthetic. The anæsthetist should be a man of pleasing manners and good address, and one selected because of the soundness of his gray matter, not because of the lack of this very essential element. He should be thoroughly familiar with physical diagnosis, and be required to examine every chest before administering an anæsthetic. He is held wholly responsible for the outcome of the anæsthetic, and should be thoroughly familiar with every abnormal condition of the heart and lungs.

#### APPARATUS

In 1908 we began the use of the Cunningham machine, and have since seen no cause to make a change. The only improvement one could suggest would be to eliminate the ether chamber, so that only a pure nitrous oxide and oxygen anæsthesia could be given. We find many reports on nitrous oxide and oxygen anæsthesia, and after going into the report we will find in as inconspicuous a place as possible that these were given with just "a little ether."

"Just a little ether" will admit of such a large personal equation that one would hardly know how to classify the anæsthetic. It could mean any amount from half a dram to several ounces. This kind of anæsthesia has had a tendency to unjustly subject nitrous oxide and oxygen to much criticism, as the nausea, vomiting, and other unpleasant effects are always in evidence where "just a little ether" is used. The comfort and pleasure associated with the taking of a nitrous oxide and oxygen anæsthesia, where there is no ether added, is one of the strong points in favor of this anæsthetic. This is not the case where ether is used.

Patients who take nitrous oxide and oxygen never dread the second anæsthetic if it becomes necessary, while those taking ether anticipate the second with dread.

Any apparatus in which the gases can be mixed in definite proportions is all that is required. The very large tanks of gas are decidedly preferable to the smaller, as the gas can be made to pass through a gauge, and a constant flow can be maintained into the bags.

## REBREATHING

The question of rebreathing of the gases is one which has been much discussed, and there are men whose opinion is certainly worthy of careful consideration who advocate this. The two arguments advanced are that this renders the nitrous oxide and oxygen method much cheaper, and that the  $\text{CO}_2$  is a respiratory stimulant. The first is certainly no argument, as the question of cheapness should never be considered when we are dealing with a human life. That  $\text{CO}_2$  is a respiratory stimulant has been proven, and in many cases it is extremely useful. It would certainly seem to be far more desirable if we could furnish this respiratory stimulant to our patient in the proportion we wish than to depend on our patient manufacturing the  $\text{CO}_2$ , if a respiratory stimulant is required. I do not think anyone will contend that the other products of expiration would be an advantage. If so, then our mode of constructing buildings is all wrong. We have always endeavored to so construct and ventilate our public buildings and bedrooms that rebreathing might be eliminated. We can easily dispense with rebreathing if we desire to give an anæsthetic free from all poisonous products by adding to our machine a small tank of  $\text{CO}_2$ . This is manufactured by the same concern which manufactures the other gases. I have during the past year used this method of stimulating the respiration where a respiratory stimulant was demanded, and it has proven very satisfactory indeed.

Other questions to be considered are whether or not it is dangerous to permit patients to breathe from a gas bag into which other patients have breathed, many of whom may have been tubercular. This would certainly seem to be a very excellent medium through which the disease might be communicated, and I am quite sure none of the enthusiastic advocates of rebreathing would look forward with pleasure to breathing from the same bag into which a tubercular patient had just exhaled. I do not think the bags, tubes, and machine can well be sterilized after each operation, as the bags I have seen would not bear boiling, which is the only sure method of sterilization.

COMPLICATIONS AND ALARMING SYMPTOMS  
ON THE TABLE

The greatest danger from a nitrous oxide and oxygen anæsthesia is failure of respiration. This can in most cases be overcome by the careful watching of the respiratory excursion, and the giving of the proper percentage of oxygen and  $\text{CO}_2$ . One can cause his patient to breathe just as he desires by the use of the carbon dioxide gas. Often, before we began the use of the carbon dioxide, we would have a suspension of respiration, which would be easily overcome by giving a light blow over the epigastric area.

The heart does not seem to be in the least affected if plenty of oxygen is given. If we permit the patient to become cyanotic, the pulse rate is decreased; or if he come too far out from under the anæsthetic, the pulse rate is at once increased.

## POST-OPERATIVE COMPLICATIONS

I think it is the accepted conclusion of those who have devoted any study to this form of anæsthesia that we have none of the post-operative complications so often seen after ether and chloroform.

## MORTALITY

No one will deny that there is a mortality rate to nitrous oxide and oxygen anæsthesia. What that rate is I do not think we can say until many more thousands have been given.

I think, however, that many of the deaths reported should not be charged against the anæsthetic, and this agent condemned, for it is often administered by one who knows nothing of this anæsthetic, and more frequently they are mixed anæsthesias, and not nitrous oxide and oxygen at all.

In the giving of several poisons it is unfair, should evil result, to select one and lay the entire blame to it, when the symptoms and death could as easily be induced by any one of the agents used. In a recent correspondence relative to a death in which ether and nitrous oxide and oxygen were given, the anæsthetist maintained that, the death being due to paralysis of respiration, it was of necessity a nitrous oxide death. I note the report of a death from ether anæsthesia by the late

Maurice H. Richardson. Had nitrous oxide and oxygen been used in conjunction with the ether, I am quite sure it would have received credit for this death, as it was from paralysis of respiration. Artificial respiration was performed for 21 hours, but never during this time did the patient make any effort to breathe. While the artificial respiration was performed the patient remained pink, but the moment it was discontinued she began to grow cyanotic.

#### ADVANTAGES OF NITROUS OXIDE AND OXYGEN ANÆSTHESIA

- 1 Rapidity of action
- 2 Lack of unpleasant sensations to patient
- 3 Absence of post-operative complications
- 4 Reduction of post operative vomiting
- 5 Absence of blood changes
- 6 Lessened liability to shock
- 7 Rapid return to consciousness
- 8 Lack of dread should future anæsthetic be demanded

In briefly discussing the advantages of a properly administered nitrous oxide and oxygen anæsthesia, (1) the rapidity with which the patient assumes the unconscious state is very desirable, and he does not have the ten minutes or more of the irritating action of ether on his air passages. I note that some of the gas oxygen anæsthetists state they have the patient ready for operation in thirty seconds. This is surely a mistake, and will often be accompanied by marked cyanosis. It is best, in my opinion to take at least three or four minutes to get your patient thoroughly anæsthetized, and he will be a much better subject for operation than where he is hastily "pushed under" the anæsthetic. (2) He does not have any unpleasant sensations, regardless of the manner of administering the gas. I have given this anæsthetic to many doctors, and they all say the sensation of going under the gas is very pleasant indeed. They usually report having very extensive dreams, but can seldom recall of what they dreamed. (3) The absence of post-operative complications is very noticeable. I have never seen a case of pneumonia or nephritis follow

the use of nitrous oxide and oxygen. (4) The post-operative vomiting is greatly reduced in frequency, and the prolonged vomiting quite frequently seen after ether or chloroform is never seen. If the patient is placed in the Trendelenburg position he will quite frequently regurgitate water and gastric juice while on the table. (5) Absence of blood changes has been worked out by Hamberger and Ewing.

In those patients who are so profoundly septic we do not so often find shock present, and there is never the rapid march to a fatal termination which is so often seen following ether. They rapidly return to consciousness, and are in much better condition to fight the infection than they would be if there had been added to their already poisoned condition another toxic element. Any surgeon who has ever found it necessary to again operate on a patient is familiar with their great dread of again taking ether. In most cases this is far greater than the dread of the second operation.

#### DISADVANTAGES

- 1 The necessity of a trained anæsthetist for this class of anæsthesia
- 2 Cost of the anæsthetic agent
- 3 Rigidity and movement in some cases

Under disadvantages one would place first the necessity of a trained anæsthetist, but I doubt if this should be done, as the same might apply to the art of surgery. One never hears that the great disadvantage attending a grave surgical operation is that it requires a trained surgeon, or that the great disadvantage in the management of a case of typhoid fever is that it requires a trained physician. It is taken for granted that the latter two should be trained, and the same should apply to the former. The rigidity of the muscles and movements of the patient is sometimes annoying to the surgeon, but in a great many of these cases if the surgeon will exercise patience the anæsthetist can get the subject more deeply under the anæsthetic, so that a difficult ligation or other procedure can be more easily accomplished.

One point of interest is if these movements are due to the pain from manipulation, and if it is harmful to the patient. All patients will tell you they felt no pain during the opera-

tion, though they may have shown signs of pain during its progress. A point worth considering is that one may have a nerve extracted and other painful dental work done while taking a very slight amount of gas, and they will feel no pain, although they will obey the command to spit the saliva from their mouths. Again, Dr. Dawson has used this quite extensively in obstetrical work; and the patients will say they recall quite well when the child was born, but felt no pain at its birth. It would seem if there is no pain under so slight an anæsthesia, there would be none if the anæsthesia were pushed beyond this stage. I have seen no evil results following in those cases where the patients were not thoroughly relaxed and moved, but it is much more difficult to perform the operation.

Having used this anæsthetic during the past five years, and observed its administration in 2500 cases, I feel I know something of its good and bad qualities, but I fully appreciate how far from settled is the question of the best method of producing anæsthesia at the present day. We find the surgical world

is becoming more interested in this very important field, and it is to be hoped that at no very distant day this question may be answered.

#### CONCLUSIONS

1 That this anæsthetic may be administered in all cases where a general anæsthetic is required. I would not presume to say it is the best in all cases.

2 That it may be used without the addition of ether or without the preliminary of morphin.

3 That most adults take the anæsthetic easier and are better subjects for the operation if a preliminary of morphin, gr  $\frac{1}{4}$ , and atropin, gr  $\frac{1}{100}$ , is given.

4 That children should never be given morphin before operation.

5 That the recoveries in patients suffering with severe septic infections are much greater when this anæsthetic is used.

6 That we do not have any post-operative complications when this anæsthetic is used.

7 That it should never be given except by one thoroughly trained in this work.

## ANÆSTHESIA AND ANOCI-ASSOCIATION<sup>1</sup>

By GEORGE W. CRILE, M. D., CLEVELAND

**P** RINCIPLE The nerves whether of the special senses or of common sensation, are fuses, which when ignited (that is, stimulated) cause release of energy in the magazine (the brain cells). Inhalation anæsthesia puts to sleep only a portion of the brain, if all of the brain were anæsthetized the patient would be dead. Now the vast army of awake brain cells respond actively to the trauma of operation. This response, or release of energy in the brain cells, is an effort to escape from injury, and this release of energy is not prevented by inhalation anæsthesia. The stored energy of the brain cells is therefore consumed during surgical operations or during psychic strain. The prevention of this consumption is one of

the great outstanding problems of operative surgery. Obviously the only practical method of preventing the consumption of this stored energy of the brain cells is the development of a new principle of operative surgery, the practice of which will exclude from the brain the stimuli of the special senses and the stimuli of common sensation.

This is the principle of anoci-association, meaning the exclusion of all nocuous or harmful associations or stimuli.

There is not a single anæsthetic that will exclude all nocuous or harmful stimuli from the brain. Local anæsthetics, by blocking nerve conduction, protect the brain from local operative injury, but they do not protect the brain against destructive psychic strain.

<sup>1</sup> Read before the Clinical Congress of Surgeons of North America, New York City, November 12th, 1912.

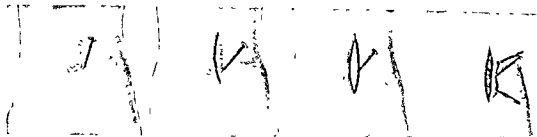


Fig 1

Fig 2

Fig 3

Fig 4

Fig 1 Infiltration of skin and subcutaneous tissue with  $\frac{1}{4}\%$  novocain

Fig 2 Infiltration of fascia and muscle

Fig 3 Infiltration of posterior sheath and peritoneum

Fig 4 Peritoneum inverted Infiltration with  $\frac{1}{2}$  per cent of quinin and urea hydrochloride

Inhalation anaesthetics exclude the psychic stimulation of the brain cells, but do not exclude the operative stimulation. Anaesthetics introduced hypodermically are excluded on principle. Each anaesthetic covers only a part of the field, each has its advocates, but there is no single agent that alone can produce anoci-association, which is the goal of operative surgery. We therefore do not advocate ether alone, nor chloroform alone, nor nitrous oxide alone, we do not advocate local anaesthesia alone, nor morphin and scopolamin alone, nor spinal anaesthesia alone; but through selection and combination of the various anaesthetics, we aim to exclude on the most favorable terms all stimuli from the brain.

The description of this technique will be limited to abdominal and exophthalmic goiter operations, which will serve to illustrate the principle.

#### ABDOMINAL OPERATIONS

1 Excluding infancy, old age, and depressed vitality, we first administer, as an average  $\frac{1}{4}$  grain of morphin and  $\frac{1}{16}$  grain of scopolamin one hour before operation.

2 If local anaesthesia alone is employed, novocain in  $\frac{1}{4}\%$  solution is used by progressive local infiltration.

3 If inhalation anaesthesia is employed, we then administer nitrous oxide, either alone or with ether added as required.

4 As soon as the patient is unconscious, infiltration, first of the skin and then of the subcutaneous tissue, with  $\frac{1}{4}\%$  novocain is made. In order to spread the novocain,

immediate local pressure with the hand is applied. Anaesthesia is immediate. Incision through this anesthetized zone exposes the fascia. The fascia is then novocainized, subjected to pressure, and divided. This brings us to the remaining muscle or posterior sheath and to the peritoneum. These structures are then infiltrated with novocain, subjected to pressure, and divided within the blocked zone. If blocking has been complete, upon opening the abdomen no increased intra-abdominal pressure will be found, no tendency to expulsion of the intestines, and no muscular rigidity.

5 The peritoneum is everted and infiltrated with  $\frac{1}{2}$  per cent solution of quinin and urea hydrochloride completely surrounding the line of proposed sutures and momentary pressure is applied. This infiltration serves as a block, and as it lasts several days it should prevent or at least minimize the post-operative wound pain and the post-operative gas pains, and by so much minimize post-operative shock.

6 The relaxed abdominal wall will permit the gentle and easy exploration of the entire abdominal cavity. If there is no cancer in the field of operation and no acute infection, the following regions may be blocked as completely and in the same manner as the abdominal wall, viz. the meso-appendix, the base of the gall-bladder, the uterus, the broad and the round ligaments, and any portion of the parietal peritoneum. Operations on the stomach and intestines made without pulling on their attachment cause no pain, hence require no novocain block. Quinin and urea causes

a certain amount of œdema of tissue, which lasts for some time after the wound is healed.

The closure of the upper abdomen is then as easy as the closure of the lower — all is done with the ease of relaxation. What is the result? No matter how extensive the operation, no matter how weak the patient, no matter what part is involved, if *anoci* technique is perfectly carried out the pulse rate at the end of the operation is the same as at the beginning; the post-operative rise of temperature, the acceleration of the pulse, the pain, the nausea, and the distention are minimized or wholly prevented.

#### GRAVES' DISEASE

I believe everyone will agree that a technique that can carry an advanced exophthalmic goiter case through operation without increasing the pulse rate can even more readily do as much for any other operation. This can be done by the following technique, the operation being either ligation or lobectomy.

If ligation is made, it is performed without removing the patient from his bed. In performing ligation nitrous oxide may or may not be administered, but a complete local blocking with novocain is always employed during operation as is also a complete quinin and urea hydrochloride infiltration at the close of the operation, thereby blocking the entire raw field of operation.

If lobectomy is to be performed, the patient is anesthetized with nitrous oxide in his own room; fictitious anesthesia having been daily given for several days previous to the operation, the patient is anesthetized free from psychic strain, being under the impression that he is receiving an inhalation treatment. When under anesthesia the patient is taken to the operating room. The division of tissue is preceded by a complete blocking, so that no activating impulse can reach the brain. Before closing, quinin and urea hydrochloride is infiltrated into every part of the raw field with a hypodermic needle. The patient is kept unconscious, under anesthesia, until returned to his room, put to bed and his room restored to its previous condition. In the course of the cycle from his room to operation and return, the brain has received

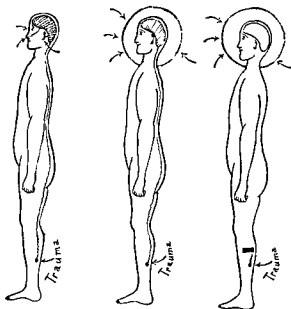


Fig. 5 Anoci association diagram. 1 Auditory, visual, olfactory, and traumatic noci impulses reaching the brain. 2 Auditory, visual, olfactory associations excluded. 3 Nerve blocked by cocaine, patient in anoci association.

no activating stimuli so there can be and there is no change in the pulse.

The immediate control, however, is not the end of the benefits. The post-operative hypothyroidism is prevented or minimized and to the same extent that the immediate results are improved so are the later clinical results improved.

What happens to a case of Graves' disease not under surgical treatment when subjected to a severe psychic shock — to a heavy strain or to deep worry? The disease is aggravated for weeks or for months, and not infrequently death results. The stress of facing the operating room is not only immediately seen, but is perpetuated in the following days and weeks and months by its frequent recall. From this handicap the *anoci* patient is free, and by so much is the convalescence sped on its way.

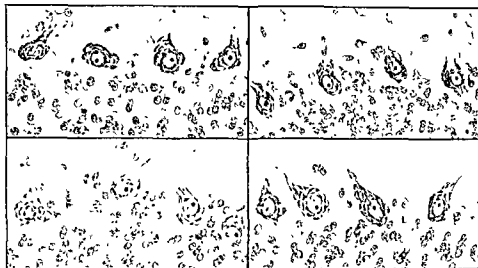
#### SUMMARY

- 1 The technique of surgery the world over is now well standardized.
- 2 One of the greatest outstanding problems is the elimination of the harmful effects of the

## CEREBELLUM

Normal dog

Anoxic shocked dog Cerv. cord severed



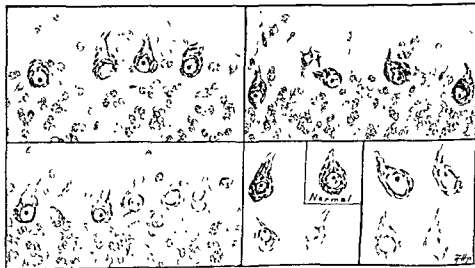
Shocked dog Ether anesthesia

Shocked dog N<sub>2</sub>O anesthesia

## CEREBELLUM

Normal rabbit

Rabbit Fright



Rabbit two hours after fright

Characteristic changes in brain cells in fright. Hyperchromatic during fright. Exhausted after fright.

Characteristic changes in brain cells in shock. Note swelling and rupture of nucleus and mitobodies.

Degree	98	99	100	101	102	103
Ether						
N <sub>2</sub> O						
Anoci						

Beats	70	80	90	100	110	120
Ether						
N <sub>2</sub> O						
Anoci						

Chart 1 Abdominal hysterectomy The temperature Each heavy line represents the average 500 p m temperature of ten patients during the first four days after operation The pulse Each heavy line represents the average 500 p m pulse rate of ten patients during the first four days after operation.

Degree	98	99	100	101	102	103
Ether						
N <sub>2</sub> O						
Anoci						

Beats	70	80	90	100	110	120
Ether						
N <sub>2</sub> O						
Anoci						

Chart 2 Thyroidectomy The temperature Each heavy line represents the average 500 p m temperature of ten patients during the first four days after operation The pulse Each heavy line represents the average 500 p m pulse rate of ten patients during the first four days after operation

necessary surgical procedure, including the anæsthetic, thus further diminishing the post-operative morbidity and mortality

3 These harmful effects are now known to be due to exhaustion of the brain cells from psychic and traumatic stimulation

4 These traumatic stimuli reach the brain and cause discharge of brain cell energy under inhalation anæsthesia

5 This brain cell activity is accomplished through oxidation

6 Nitrous oxide owes its anæsthetic properties to its interference with the use of oxygen by the brain cells, hence nitrous oxide by so much protects the brain cells during a surgical operation by diminishing the oxidation, and hence the destruction of the chemical compounds in which is stored brain cell energy

7 Powerful stimuli, whether psychic or traumatic, whether received by the brain while awake or, in case of the traumatic stimuli, whether received under inhalation anæsthesia, cause a lowering of the threshold to stimuli This lowering of the threshold is the source of the nervousness, irritability, and altered personality which so frequently follow operation

8 The principle of *anoci* is the exclusion of all harmful stimuli

9 The practice of *anoci* requires careful personal management united with the use of such chemical agents as, combined, will ex-

clude from the brain all harmful stimuli, thus taking the brain and the personality of the patient unmodified and unimpaired through the operations

Days	1	2	3	4	5	6	7
1904							
1905							
1906							

Chart 3 Mortality rate per thousand of operative cases from Lakeside Hospital

10 The patient is kept safely and agreeably unconscious while the operation is performed under local anæsthesia.

## CLINICAL RESULTS

The clinical results here reported have been confirmed by Bloodgood in his personal experience The accompanying charts show the results of a critical study of the clinical data of parallel series of operations performed by me, viz the last consecutive operations under ether alone, under nitrous oxide alone, and under *anoci*. Were it possible to express the subjective sensations of the patient, the contrast would certainly be even more striking My associate, Dr W E Lower, and I during the past year performed 629 abdominal sections, under *anoci* association with a mortality rate of 1.7 per cent



## INVERSION OF THE UTERUS

WITH REPORT OF A CASE OCCURRING DURING THE PUERPERIUM AND CAUSED BY A FIBROID<sup>1</sup>By WALTER CLINTON JONES, A M, M D, CHICAGO  
Assistant Professor of Surgical Pathology Medical Department University of Illinois

THE following case occurred in the experience of the writer and led him to a special study of this condition.

Patient, Mrs. T. J., age, 42 years. General health, good all her life. She had borne eight children, no particular difficulty having occurred in any of the labors. Her last child was born about June 30, 1912. Pregnancy and labor were normal and the puerperium uneventful till the end of the second week after delivery. She was allowed out of bed on the tenth day. On the fourteenth day she began to have moderately severe pelvic pains, a pressing down sensation in the pelvis and dysuria. Not until these symptoms had continued for a few days did she call in her family physician, Dr. E. C. Hamilton. He took her at once to the local hospital, and upon examination found a mass of indefinite shape almost filling the vagina. There does not seem to have been much hemorrhage.

The patient being rather weak, he waited until the next day before attempting to do anything radical. The following morning, he gave her an anesthetic and removed the vaginal mass cutting through its base as high up in the vaginal vault as possible. This procedure left an opening into the peritoneal cavity, through which the omentum prolapsed. This accident was controlled and the patient was put to bed. The vaginal mass turned out to be the corpus uteri and a large intrauterine fibromyoma attached to the fundus by a broad base.

All was well till the tenth day, when the patient began to show a moderate temperature. At this juncture, July 30, 1912, the writer was called to see the patient for the first time. Vaginal examination revealed the vagina empty and a cervix dilated about three quarters of an inch. Bimanually in the median line, a mass was palpable, spheroidal in shape, indefinite in outline, rather soft in consistency and apparently about 3 inches in diameter. I diagnosed her original trouble as inversion of the uterus and her present illness, pelvic infection.

I did a laparotomy at once and removed the right tube (the left one had been removed with the vaginal mass), both ovaries and a piece of omentum nearly as large as a hen's egg. All of these structures were matted together capping the cervical stump with an inflammatory mass, in the center of which was an abscess cavity containing about 3 ounces of pus. Drainage was accomplished with iodoform gauze, both abdominally and vaginally. The patient got

along very well for about a week, when she began to have temperature and local evidence of retention of pus. I then dilated the cervix with the index finger, thus facilitating drainage. Her condition improved at once and she ultimately made a complete recovery.

## PATHOLOGICAL ANATOMY

*Gross.* The specimen (Figs. 1 and 2), when I first saw it had been preserved in formalin solution. It consists of an upper portion the corpus uteri, and a lower part, the tumor, which is connected with the fundus of the uterus by a broad pedicle. The body of the uterus is about 9 cm. in diameter and the tumor, about 10 cm. The length of the whole specimen is about 20 cm. It weighs one pound and six ounces. The serous surface is perfectly smooth and glossy but thrown into folds on account of the lessened area it has to cover. The mucous surface is smooth but not glossy, though under tension on account of being stretched over an area larger than normal. The left tube is attached to the inner or serous surface and is entirely normal in appearance, while hanging from it near its distal end is a small cystic hydatid of Morgagni.

The uterus is light in color and very firm in consistency, while the tumor is of a darker hue and a little softer. The thickness of the wall of the uterus is about  $3\frac{1}{2}$  cm. and the wall of the tumor, about 2 cm. In the interior of the tumor is a cavity which in the fresh specimen must have been spheroidal in shape and large enough to contain 5 or 6 ounces of fluid. At the most dependent portion of the tumor is an opening into this space, irregular in shape and about  $1\frac{3}{4}$  cm. in diameter. The surface of this cavity is somewhat irregular in contour, presenting in places a smooth surface, in other areas, indentations, due very likely to shrinkage of the tissues in the formalin solution. In

<sup>1</sup> Read by invitation before the Chicago Gynecological Society, December 20, 1912.

numerous spots, tags and shreds are hanging to the surface; at the outlet of the tumor cavity, these tags are large and numerous and hang downward, forming a tuft

*Microscopical.* The diagnosis of the tumor is typical degenerated fibromyoma. The fibrous tissue is more abundant than the muscle cells, and the degeneration is rather large in amount and diffuse in its distribution

This inversion is unique in that it had a double origin, a gynecological and an obstetrical. The tumor alone very likely would not have produced the inversion, for very few uterine tumors, even when submucous or intrauterine, cause this trouble, but after the uterine wall was softened by pregnancy and relaxed by a labor, the weight of the tumor became effective in pulling down the fundus. On the other hand, this case is not unique

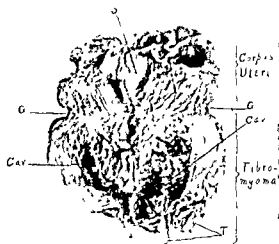


Fig 2 Same as Fig 1 showing cut surface after longitudinal incision. Cav, cavity of tumor. G, groove between tumor and uterus. S, serous surface of uterus. T, tags of tissue at outlet of tumor cavity

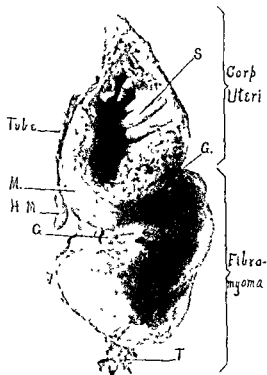


Fig 1 Photograph of gross specimen of inversion of the uterus, writer's case. G, groove between tumor and uterus. H M, hydatid of Morgagni. M, mucous surface of the uterus. S, serous surface of the uterus. T, tags of tissue at outlet of tumor cavity

but is like a large proportion of the reported cases in that the occurrence of the accident was unforeseen and could not have been avoided. The fibroid never had caused a single symptom, the labor was entirely normal, and the inversion produced such mild symptoms while it was taking place that a doctor was not called until the fundus was in the vagina. Also, the situation of this tumor at the fundus is perfectly typical, for, according to Thorn, nearly 90 per cent of fibroids which cause inversion are in this location.

In consulting the reports of several hundred cases in the literature, the writer finds only two instances in which the inversion was due to a tumor and occurred also during the puerperium. Patrick of Montreal, in 1908, described such a case from his own practice, in which the inversion probably occurred gradually from the fifth to the twentieth day of the puerperium. Tracy (1911) also describes a case of his own of 14 years' standing, which was due to an intramural fibroid in the fundus and which had developed during her last puerperium.

Pench has collected five instances from the literature in which the uterus was removed through mistaking it for a tumor. One of these patients died.

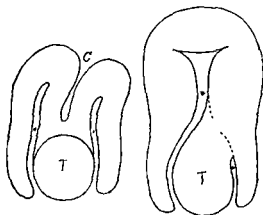


Fig 3 Diagram of incomplete inversion of the uterus caused by a submucous fibroid situated near the fundus and simulating an intrauterine polyp without inversion. C, cup-like depression on the peritoneal surface. T, tumor. Note the shortened intrauterine cavity (\*). Compare Fig 4 in which the findings at the external os are precisely similar.

Fig 4 Diagram of an intrauterine fibroid without inversion, from a recent patient of the writer's. T, tumor. Note the elongated intrauterine space (\*). Compare Fig 3, in which the findings at the external os are precisely similar.

**Etiology** The following outline gives briefly and approximately in the order of their importance the causes of inversion of the uterus.

#### A Obstetrical in Origin

##### I Primary cause

- 1 Relaxation of uterus

##### II Secondary causes

- 1 Pressure on fundus from above or traction from below
  - a Traction on cord (including short cord or cord wound around baby).
  - b Credé expression of placenta
- 2 Any factor favoring uterine inertia
  - a Prolonged labor
  - b Hydramnion
  - c Multiparity (?)
  - d Constitutional diseases, etc
- 3 Age
  - a 20-30
- 4 Idiopathic

#### B Gynecological in Origin

##### I Tumor

- 1 Usually submucous or intrauterine fibroid
- 2 Age After 30.

## II. Idiopathic.

In 1911, Thorn, in what is probably the most exhaustive research of the literature that has ever been published in the history of this subject, reported 641 cases gathered from the entire civilized world and covering a period of 22 years prior to 1911. Of these, 521 (81.2 per cent) were obstetrical (full term) in origin; 83 (13 per cent) were due to tumors of the uterus; 14 (2.2 per cent) occurred post-mortem; 13 (2 per cent) he classified as idiopathic, and 10 (1.6 per cent) occurred after abortions or premature labors. From these statistics it is evident that a discussion of this subject centers around the obstetrical instances, as this class outnumbers so greatly all others. In this group, according to Moran, inversion happens with about equal frequency before and after the delivery of the placenta. It may occur during the delivery of the baby (Barnes and Chittenden).

The following statistics will give one an idea of the rarity of this accident.

Von Braun	1 case in 250 000 labors
Madden	1 case in 100,800 labors
Cache	1 case in 4 600 labors
Winckel	0 case in 20 000 labors
Beckman	0 case in 250 000 labors
Aveling	1 case in 100 000 labors
Hirst	1 case in 140 000 labors
Kehrer	1 case in 2,000 labors
Schonbeck	2 cases in 1,500 labors
Krassowsky	1 case in 200 000 labors
Average	1 case in 128 767 labors

There is some doubt, in regard to some of the above statistics, as to whether they refer to inversions of all degrees or to complete ones only. Furthermore, the above table is compiled from hospital reports and hence, Mériel and others hold, is misleading because this accident, they maintain, is relatively more common in private homes. Hinchey, upon examination of the mortuary reports of St. Louis and after a search of the literature, concluded that this accident is more common than is usually supposed. Thorn expresses the same opinion.

In searching for the etiology proper of uterine inversion, one need not go far to discover that the great underlying cause of all acute (obstetrical) cases is *relaxation of the*

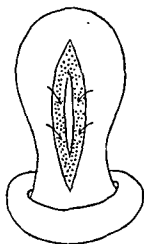


Fig. 5.

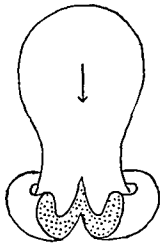


Fig 6

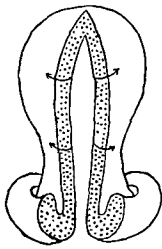


Fig 7.

Fig 5 Diagram showing the uterine incision in the posterior wall in the operation of Browne and of Küstner. In the former method, the cervix is dilated through this incision, in the latter, the cervix is reached through a posterior colpotomy and the uterus is turned inward through the uterine incision, as indicated by the arrows (Modified from Heinricus)

Fig 6 Diagram of simple cervical incision, usually made posteriorly. Reduction is accomplished by pressing

the corpus in the direction indicated by the arrow. A colpotomy usually is included in this procedure

Fig 7 Diagram of the more extensive uterine incision, usually made posteriorly. The inversion is reduced by turning the uterus in the direction indicated by the arrows. A colpotomy is almost always done as a part of this method. Note that this prolonged incision may be made by extending downward the incision shown in Fig 5 or by continuing upward the one seen in Fig 6 (Modified from Heinricus)

uterus. Probably none of the secondary factors which are active during or immediately after labor would ever produce inversion without uterine inertia. Of course, this statement does not apply to gynecological cases, for they are gradual in their development. Although uterine relaxation has been emphasized by Dudley, Ashton, McGlenn, Exchaquet, Mériel, Murphy, Lynch, Baseil and others, yet it will bear repetition here, for there are many who do not seem to appreciate its importance. Numerous writers are vociferous in condemning midwives, especially, and also physicians, for traction on the cord or an "improper" Credé. This, to be sure, is all right as far as it goes, but it does not get at the root of the trouble. Most authorities in obstetrics condemn in general any traction on the cord, but usually recommend Credé's method. As far as anyone knows, either procedure may easily produce inversion, if the uterus is relaxed. Why not, then, lay emphasis watching the tonicity of the uterus and upon the importance of carrying out no procedure whatever upon the uterus

or its contents during the second or the third stages of labor (except in emergency), unless the uterus is firmly contracted? If this rule were observed, many cases, perhaps half of them, would be prevented. In 100 tabulated cases, Vogel found in 47 instances that traction had been exerted upon the cord, while Thorn cited 11 cases in which the cord either was short or was wound many times around the body of the baby. Funic traction probably is more common as a secondary cause of inversion than is pressure upon the fundus

There remains, however, a large number of instances which seem at present to be entirely unavoidable. I refer to those that occur during or immediately after a normal or approximately normal labor which has been conducted according to the most thoroughly approved methods. In these patients, the accident occurs suddenly and without warning, once in a while even without symptoms (Barrows and others); and the fundus is down in the vagina before there is any possible chance to prevent the inversion. For the present, at least, we must call these instances

spontaneous. In 100 acute cases, Beckman found 54 to be of this nature. Of 437 post-partum inversions, Thorn finds that 145 were produced by violence, 180 were spontaneous, and that in 103 the cause was undetermined. Thus, in 334 cases in which the cause could be ascertained, 54 per cent were spontaneous. The blame in these instances lies, not in the fact that the inversion has occurred, but in the failure to make an early diagnosis and in neglecting to replace the uterus at once. In the cases where diagnosis and reposition have been accomplished immediately, both the morbidity and the mortality have been very low.

In considering the secondary causes of this condition, it is by theoretical considerations rather than by practical deductions that one places among the causes of this accident those factors which usually are accepted by obstetricians as predisposing to uterine inertia, for example, multiparity, prolonged labor, hydramnion, etc.; for one is impressed forcibly in an extensive perusal of the literature, by the large number (about 50 per cent) of cases in which none of these factors are present. In fact, according to Thorn, Vogel and others, the great majority of obstetrical instances occur in primiparæ. In these patients, the usual explanation is the following (Murphy, Dudley, Ashton, etc.): It is easy to conceive how muscular contraction is interfered with particularly at the placental site and especially while the placenta is still attached. There occurs first diffuse uterine inertia; then the relatively paralyzed placental area becomes indented by funic traction or Credé expression, by the weight of the placenta or the pressure of an overfilled colon (Scheffen) or even by a cough or a sneeze on the part of the patient. The uterine muscle exclusive of the placental spot regaining more or less of its tonicity, seizes the inactive placental depression as it would grasp a foreign body, and "in attempting to expel it turns itself inside out". (Ashton) The fact that inversion is more frequent than in multiparæ has an etiological significance per se, considering that most births are not first ones. Holmes thinks that a neurosis or a congenital failure of proper innervation may constitute the explanation

The attachment of the placenta at the fundus is held by Holmes and others to be an important etiological factor. As an illustration that this location is not essential, Thorn reports two patients and Holmes four in which inversion occurred in connection with placenta prævia. However, the fact that about 80 per cent of placenta prævias occur in multiparæ (inversion is more common in primiparæ) and that about 88 per cent of all prævia cases are delivered prematurely (about 98 per cent of obstetrical inversions occur at full term),—these statistics demonstrate that placenta prævia plays a very small if any part in producing uterine inversion.

The recurrence of obstetrical inversion in subsequent pregnancies is uncommon. In 521 cases Thorn found only 8 such instances recorded, while very many writers report cases of uterine inversion in which later labors and puerperia were entirely normal. The recurrence of inversion immediately or very soon after reduction is unusual, Thorn reporting only 14 such instances in his large series.

As to age, by far the greater proportion of all acute cases occur between 20 and 30. The following table from Beckman (1894) speaks for itself. More recent statistics gathered by the writer and others show similar percentages

Under 20 years	4 patients
From 20-25 years	38 patients
From 25-30 years	18 patients
From 30-35 years	9 patients
From 35-40 years	7 patients
Over 40 years	1 patient

Total 77 patients

Hence 73 per cent occur between the ages of 20 and 30. This finding, however, has no purely etiological significance when compared with another fact, namely, that 75 per cent of all births occur during this ten-year period. Chronic obstetrical inversions found later usually date back to the second decade for their origin. Chronic ones due to tumor arise more commonly after 30, the time when fibroids are more frequently found.

Practically all instances not obstetrical in origin are caused by fibroid tumors. As a rare exception to this rule, Thorn reports four cases produced by sarcoma and two by car-

cinoma. The fibroids usually are intrauterine or submucous, rarely intramural, and they bring about inversion very gradually. The pathogenesis in these cases is similar in principle to that in obstetrical inversion. In either case a weak spot is produced in the uterine wall; in the latter by the placenta, in the former by the tumor, due to infiltrative growth or pressure atrophy and to traction. The tumor by its presence in the uterine cavity stimulates the contraction of the normal uterine musculature and thus the inversion is produced.

Idiopathic inversions are those which have absolutely no ascertainable cause; that is, they do not occur after an abortion nor following a labor at full term; they do not present any tumor nor any other pathological lesion except the inversion. Olshausen has reported such an instance which occurred in a virgin 18 years old. These cases are very rare, only 13 having been reported (Thorn), as far as the writer knows.

*Pathology.* As to duration, inversion of the uterus is either *acute* or *chronic*. Most writers consider as acute all cases which last one month or less, while those which pass beyond this limit are classed as chronic. These latter frequently exist for many months, sometimes many years. J. H. Tate, for instance, used his method of reposition for the first time on a case of 42 years' standing. Practically all of the acute cases occur during or directly after the third stage of labor. Of the chronic inversions, one half or more are obstetrical in origin while the remainder are produced by uterine tumors.

In regard to the degree of inversion, these lesions are classified as *complete* and *incomplete*. The incomplete ones are those in which the fundus passes no farther than to the cervix. If any part of the corpus passes through the cervical ring, this stage is called complete by most writers, though Ashton, Murphy and others reserve this term for those rare cases in which the cervix also is turned inside out. A few extreme inversions have been reported (Boyd and others) in which the vagina also was more or less inverted. Practically all obstetrical instances are inversions of the entire corpus, not

including the cervix. Judging from reports in the literature, it is a very rare finding indeed to discover an obstetrical inversion at the incomplete stage. The writer knows of but one such instance, which was reported by Summers of St. Louis. In inversions caused by tumor, Thorn found 25 per cent partial and 75 per cent total.

The most important pathological point is the *cervix*, the control of which is the key to the treatment. In all chronic cases, it is firmly contracted. In acute cases, it becomes contracted early, usually within a few hours and sometimes within a few minutes, thus preventing what otherwise would be an easy reposition. Practically all therapeutic measures are aimed chiefly at overcoming cervical resistance. Rigidity of the corpus, however, in some chronic inversions is very important, necessitating incision through the body of the uterus as well as through the cervix in order to accomplish reduction.

Viewing the pathological anatomy vaginally in a typical case, we find that the shape of the inverted corpus is that of a pear with the large end downward. It is large in acute cases, in chronic cases, smaller, a high degree of involution sometimes taking place in inverted uteri (Hoover and others). If the circulation is obstructed, the uterus is large and œdematous, if the circulation is cut off entirely, as has happened in a very few instances, gangrene results (Thorn).

Whether the uterus is wholly within the vagina, partly outside, or wholly outside the vulva depends on the degree of the inversion, the amount of associated prolapse and the length of the uterus. The placenta is attached more or less completely in about half of the obstetrical inversions. Also, in these recent cases, one usually can demonstrate the openings of the Fallopian tubes while later this is difficult or impossible.

Viewing this lesion from the peritoneal side, we find at the uterine site a depression, more or less elongated, depending upon the degree of the inversion. Into this cup are pulled the inner portions of the broad ligaments, the proximal ends of the tubes and, in extreme cases, the entire tubes together with the ovaries. The omentum or the

intestines may fall down into this opening. One case of acute ileus has been reported due to this rare accident (Benson). A portion of the bladder may also be drawn in (Hinchey); and in nearly all cases, and especially in the chronic ones, there is more or less traction on this organ, producing dysuria, etc. In 83 inversions caused by tumor, Thorn found 7 instances of bladder diverticulum, and in these, vesico-vaginal fistula occurred after operation. Adhesions between the infolded peritoneal surfaces are rare. Thorn found only 5 such instances in a large series of chronic cases.

*Symptoms.* There may be very few subjective symptoms or possibly none at all, even in acute cases, but this is very rare. Barrows describes a very remarkable case of his own in which inversion occurred immediately after the delivery of the baby. He detached the placenta at once and quickly replaced the uterus and the patient never suspected that anything unusual had happened. Bell and Reeve have reported similar cases. Practically all acute inversions, however, show marked symptoms, and the most important of these come under two heads, *hemorrhage* and *shock*. Pain also is a prominent manifestation. In chronic cases, if one add to the symptoms of uterine prolapse (pain in back, bearing down sensation, bladder and rectal irritation, etc.) those of hemorrhage and its consequent anemia, etc., the clinical picture is sufficiently complete for chronic uterine inversion.

The physical findings in a typical acute complete case are as follows: Vaginally, a large, red, rather soft, bleeding, pear-shaped tumor with minute tubal openings, one on either side of the large lower end. Following this tumor upward, one finds no cervical os but instead a shallow fornix all the way around the neck of the tumor and above this the cervical ring, usually more or less contracted. Abdominally, one fails to find the corpus uteri, and at the point which corresponds to the normal cervico-corporeal junction, is found a cup-like depression. This latter may be difficult to detect, except in thin-walled abdomens. In chronic inversions, the vaginal tumor is smaller, less red, not so

soft, and it does not bleed so easily; also, the tubal openings can seldom be demonstrated.

*Diagnosis.* From the subjective symptoms alone, one can never more than suspect the existence of inversion of the uterus. The diagnosis is made exclusively from the physical signs. These already have been described in our discussion of pathology and symptoms and need not be repeated here. In thick-walled women, one will be aided greatly in determining the absence of the corpus from its normal location by using a sound in the bladder and one or two fingers in the rectum. In acute cases, the diagnosis is easy from the vaginal findings alone. However, in one instance at least, it has been mistaken by a physician for a "bleeding tumor." When the symptoms are not acute, inversion frequently is entirely overlooked for many days or several weeks or months and in rarer instances for many years. In 191 obstetrical inversions analyzed by Thorn, 19 were diagnosed immediately post-partum; 44, directly after the delivery of the placenta; and 141, within 12 hours. In 158 cases diagnosed later, 67 were discovered under six weeks; 52, within six months; and 40, after one year. Peterson describes a case which was not diagnosed for 12 years and Reece, one which was overlooked for 25 years. As far as the writer can judge from the data given in the various reports, in by far the greater proportion of the cases in which inversion is overlooked the error is due, not to misinterpretation of diagnostic signs but to neglect in making any examination at all.

The differential diagnosis in gynecological cases sometimes is very puzzling, especially when a fibroid is present simulating the corpus rather closely in size, shape and position or when the tumor is very large so that it obscures the whole field (Hinchey). Gynecological inversion without a tumor is very rare. Hence, in actual practice one usually has to differentiate only between fibroid with inversion and fibroid without inversion. The key to the situation here is the length of the uterine canal, a *fibroid* always producing *elongation* while *inversion* always *shortens* it. Fig. 3 represents a typical inversion produced by a submucous

fibroid located near the fundus. Note the shortened uterine cavity on all sides of the presenting mass. At no point will the probe pass the normal distance. Compare Fig 4, a diagram from a recent case of the writer's, where the uterine space is much elongated; the sound passes freely on all sides except where the base of the tumor prevents. Similarly, if the tumor were attached to the fundus instead of laterally, the probe would pass high up on all sides of the fibroid. If, combined with the tumor shown in Fig 4, there were a moderate inversion at its base, the length of the uterine canal would be about normal or a little less. Therefore we may say, for all practical purposes in gynecological diagnosis, that a tumor-like mass protruding at the external os plus marked elongation of the uterine canal equals fibroid without inversion. This same mass plus a normal or slightly shortened intrauterine space equals fibroid plus moderate inversion. This mass plus marked shortening of the intrauterine cavity equals fibroid plus more marked inversion. Marked protrusion through the external os with a very much shortened uterine canal probably would mean inversion without a tumor. The cup-like depression in the peritoneal side of the uterus produced by inversion is an exceedingly important aid in diagnosis whenever it can be palpated. When inversion with a fibroid is well advanced there may be an indentation between the tumor and the uterus, as in the writer's case (Fig. 1).

Dudley illustrates by diagram a puzzling condition where a subserous fibroid projects into the abdominal cavity simulating closely a corpus uteri, while the body of the uterus is entirely inverted. He does not say whether such a case has ever occurred. The diagnosis of a beginning inversion at the base of a submucous benign tumor is very important; otherwise, in removing the tumor one may cut too deeply and remove also the bottom of the cup, thus making a hole through the uterus (Browne and others).

**Prognosis.** Like most emergencies, the earlier acute uterine inversion is recognized and treated, the better is the outlook. This statement applies in less degree to chronic

inversion. If left to themselves, the majority of acute cases die of shock or hæmorrhage, or later from infection. Chronic cases may last for years without marked symptoms. Beckman gives the mortality in acute cases as 14 per cent, McGilinn, as 70 per cent; Kehrer, as 25 per cent, and Crosse (1847), as 75 per cent. In 399 acute inversions cited by Thorn, 64 (16 per cent) died: 33 from hæmorrhage, 14 from shock, 15 from sepsis, and 2 from lung embolism. In 83 chronic cases caused by tumors (including four *malignant* ones), collected by the same writer, the mortality was 8.5 per cent, one of these deaths being caused by hæmorrhage and the rest by cachexia and infection. Croisic has collated 400 cases, including both acute and chronic, in which the mortality was 35 per cent. Of 109 fatalities in acute cases, 72 died within a few hours, the majority within half an hour, 8 died in from one to seven days, and 6, in from one to four weeks. In 104 chronic inversions, there were only 7 deaths. Murphy and Lynch say, "Statistics show that if the inversion is not reduced the danger after the first month is slight, but increases again with the resumption of menstruation, which is often hæmorrhagic."

**Treatment.** Considering the comparatively small number of uterine inversions that have occurred in the history of medicine, the variety of the methods of treatment is exceedingly great. A large proportion of those who have treated this lesion either have originated new procedures or have enlarged upon older ones. The following outline gives a synopsis of the various methods, new and old.

### A. Non-Operative

#### I. Spontaneous reposition.

#### II. Manual reposition

1. One hand on the abdomen, the other hand as follows:
  - a. Indentation begun at *fundus* (Emmet, etc.).
    - (1) At center.
    - (2) At one cornu.
  - b. Indentation begun near *cervix* (Hirst, Fraser, Gurney).
2. Two fingers on cervix through rectum, both thumbs on fundus (Courtney).



3. Two fingers of one hand on cervix through rectum; one finger of other hand in bladder as follows:

- a. Through urethra (Tate-Dandridge).
- b. Through vesico-vaginal incision (Dudley).

### III. *Mechanical appliances.*

1. Tamponade of vagina with gauze, etc
2. Bags in vagina distended with water, air or mercury
3. *Repositors* (Aveling, Lawson Tait, White, Byrne, Wing, etc.).
  - a Pressure exerted by arms or body of operator.
  - b Pressure effected by elastic bands extending from repositor to waist belt on patient.

#### *B. Operative*

### I. *Operations upon the cervix.*

1. Incisions.
  - a. Extraperitoneal (vaginal).
    - (1) Incomplete (Aran, Hirst, Barnes, Sims).
    - (2) Complete.
      - (a) Anterior
      - (b) Posterior (Hirst).
  - b Intraperitoneal
    - (1) Vaginal
      - (a) Anterior
      - (b) Posterior (Hirst).
    - (2) Abdominal.
      - (a) Anterior
      - (b) Posterior } (Everke).
2. Dilatation.
  - a Vaginal, through incision in posterior wall of uterus (Browne).
  - b. Abdominal, through laparotomy incision (Thomas).

### II. *Operations upon the corpus.*

- 1 Vaginal *Posterior colpotomy*; longitudinal incision in posterior wall of corpus; control cervix with two fingers in posterior cul-de-sac — Kustner's operation

### III. *Operations upon both cervix and corpus.*

Incision of the entire cervix and more or less of the corpus.

1. Vaginal.

#### a. Anterior.

- (1) Extraperitoneal (Kehrer).
- (2) Intraperitoneal (Spinelli, Thorn, Ovi).

#### b. Posterior — Intraperitoneal (Piccoli, Josephson, Morisani, Duret, Prunsi, Borelius, Westermarck, Sava).

#### c. a and b (Jones).

#### 2. Abdominal

##### a. Anterior.

##### b. Posterior (Vignard, Gross, Haultain).

### IV. *Manual reposition with one hand through abdominal incision* (Boyd).

### V. *Hysterectomy.*

1. Vaginal } a. Partial.
2. Abdominal } b. Complete.

#### *C. Treatment of Placenta*

#### I. *Removal before reposition.*

#### II. *Removal after reposition.*

The simplest way by which uterine inversion may be corrected is through spontaneous reposition. Thorn has collected from the literature 13 such instances in acute cases. Boxall has reported a case which occurred as late as three weeks after delivery. Though a fortunate occurrence, spontaneous reduction is so rare that it cannot be relied upon except in some incomplete inversions and for the last stage of reposition in complete cases. When all of the corpus has been pressed up well above the cervical ring, the rest of the reduction is nearly always spontaneous. Johnstone says, "When the fundus has been reduced within the external os . . . the uterus will reinvert itself like an india-rubber cup, turned not quite half inside out." Sometimes this final stage is completed with much force. Parker describes cases of his own in which it took place with an audible thud, and McGlinn, a case in which the "uterus sprang back like an indented rubber ball." Jaeger relates an instance from his own experience in which the final rebound of the uterus threw to the floor some instruments which were lying on the patient's abdomen. Thorn found 8 cases in his series in which reposition was reported as occurring with a jerk or a snap

In contrast with these experiences, Boyd describes an unusual case of his own in which he had great difficulty in completing the reposition after the fundus had been pushed up above the internal os.

Simple manual reposition is such an ancient procedure and is so widely employed throughout the entire world that I am unable to find anyone who claims to be the originator of this method. The indentation usually is started at the fundus, either near the center or at one of the horns. The starting of the pressure near the cervical ring (Hirst, Fraser, Gurney) instead of at the fundus is a procedure not so widely known, though it is a very valuable detail, because in some cases it will succeed when pressure on the fundus has failed.

Manual reposition should be attempted as early as possible, before contraction of the cervix has become well marked, in order to avoid this great obstacle to all methods of reposition. In recent obstetrical inversions, if there is much difficulty on account of cervical resistance, Dudley suggests that the pressure be exerted during the intervals of relaxation between the uterine contractions. As to a waiting policy, Hoover, of England, stands practically alone in advocating that "mere displacement should be ignored until shock, which is so frequently present, has been satisfactorily treated." In 79 cases of immediate replacement in the presence of shock, he found the mortality to be 30 per cent, while in 47 cases with marked shock which were allowed to become chronic the mortality was less than 5 per cent. He advocates an intermediate course. First he treats the shock for a few hours and then under anesthesia reduces the inversion. Practically all other writers, on the other hand, are very insistent on *immediate* replacement in all acute cases.

About 1875, Courty, realizing the difficulty in controlling the cervix, introduced the procedure of placing two fingers of one hand in the rectum and both thumbs upon the fundus. This was a helpful idea but fell far short of solving the problem for a majority of cases. In 1878, J. H. Tate, of Cincinnati, tried Courty's method on a patient and failed. At the suggestion of Dandridge, who was a

spectator at the operation, he inserted into the bladder through the urethra the index finger of the hand in the vagina. Reduction was thus accomplished rather easily in about half an hour, although the inversion had existed for about 42 years. Dudley has suggested that if this method be used, the finger in the bladder be inserted through a vesico-vaginal incision in order to avoid injuring the urethral sphincter.

As to vaginal tamponade and colpeurynters, comparatively little is said about them in the literature and they seem to be of but little value. In case one employs vaginal bags, if fluid is used to distend them, he must be sure it is sterile in order to avoid infection in case of leakage or rupture. Gariel used a bag which he distended with air.

Mechanical contrivances to aid in reposition have been invented by a large number of obstetricians and gynecologists. Wing devised a "doughnut" pessary repositor; White, a spiral spring, Lawson Tait, a contrivance of his own, but the best known and the most widely used of all of these probably is Aveling's repositor, described by its inventor in 1886. By 1901 it had been used at least eleven times successfully, and about three failures were recorded against it. All repositors should be employed with great care. To continue their use for five or six weeks uninterruptedly, as advocated by Ashton, involves unwarranted danger from lacerations, hæmorrhage and especially infection. Even as late as 1906, Ashton recommended manual reposition and the use of repositors to the absolute exclusion of any sort of cutting operation. Fortunately, however, as the writer thinks, he stands practically alone in this extreme position.

The following statistics, compiled by Thorn, give an adequate idea as to the relative frequency with which the various non-operative methods are used.

Manual reposition	166 times
Colpeurynter	16 times
Aveling's repositor	8 times
Tamponade and colpeurynter	7 times
Tamponade	5 times
Gariel Galbin instrument	3 times
Total	205

In at least 7 of these cases treated by non-operative reposition, the uterus was badly injured.

In order to control hemorrhage, Thorn recommends that an elastic rubber tubing be drawn tightly around the base of the inverted corpus. The inefficiency of this suggestion lies in the fact that sterile rubber tubing is seldom at hand outside a hospital, also, the strangulation thus produced may itself cause collapse (Spiegelberg).

Cutting operations of a minor nature were employed vaginally on the uterus more than fifty years ago. In 1858, Aran; in 1866, Sims; and still later, Barnes used superficial uterine incisions to assist in reposition. T. G. Thomas, however, in 1872, was the first to report the use of an extensive cutting operation for this condition. In his first case, through a small incision in the anterior abdominal wall, he distended the cervix with a metal dilator and accomplished an easy reposition, the patient making a good recovery. Several others tried Thomas' method, some as he had done it, others with modifications. For example, Everke (1899) made anterior and posterior cervical incisions by the abdominal route to facilitate dilatation and reduction, while Haultain (1908), through a similar opening, made a cervical incision posteriorly and extended it into the corpus as far as was necessary to accomplish reduction. Vignard, Gross, and Nufiez also have treated uterine inversion successfully by this method. Boyd (1912) used a laparotomy to aid in manual reposition merely by placing one hand on the cervix through an anterior abdominal incision.

Several fatalities followed Thomas' method in the hands of other operators. For this reason and because a celiotomy seemed an unnecessarily serious operation, others sought to attack the cervical ring from below. In 1883, Browne made known his simple and ingenious procedure, which he had carried out successfully on a case of his own. He dilated the cervix through an incision in the posterior wall of the corpus (Fig. 5), sutured the incision and then replaced the uterus by simple manual reduction. Ten years later (1893), Kustner published a description of his operation. He made a uterine incision precisely

similar to that of Browne's; in addition, however, he did a posterior colpotomy and through this opening controlled the cervix during reposition and sewed up the uterine incision after reduction. An opening for drainage was left in the posterior cul-de-sac.

Browne's operation in America and Kustner's in Germany marked the beginning of the modern and most approved method in difficult cases, namely, posterior colpotomy and incision of both the cervix and the corpus (Fig. 7). Piccoli, in 1893, was the first to suggest this more extensive procedure, while Josephson, in 1894, was the first to try it on an actual case. He failed, however, and performed a hysterectomy. Morisani, in 1896, carried out the operation for the first time successfully. The following year it was done by Sava, and Westermarck; the next year (1898), by Borelius, Pruntsi, and Duret. Most if not all of these men performed the operation without knowing that it had been done by the others. By a rare coincidence, Borelius and Pruntsi did it on the same day (May 26, 1898). Therefore, to christen this procedure by its full name according to its fathers and godfathers, we should call it the Kustner-Piccoli-Josephson-Morisani-Sava-Westermarck-Borelius-Pruntsi-Duret operation.

This same method was developed a little later by American operators in the following manner: I have already referred to the superficial uterine incisions made through the cervix by Aran, Sims and others. In 1900, Hirst carried this idea forward to a complete extraperitoneal incision of the cervix (Fig. 6). Very soon afterwards, in difficult cases, Hirst and others extended this incision more or less into the body of the uterus (Fig. 7), including also a posterior colpotomy.

During almost exactly the same years that Josephson, Duret, etc., were perfecting their method, Kehrer, Spinelli, Thorn, Ovi, and others were developing a precisely similar operation anteriorly. Kehrer in 1898 reported his method of using an extraperitoneal incision extending through the entire anterior wall of the uterus. As he replaced the uterus, he inserted the uterine sutures before any given portion of the uterus had been pushed in

too far to be reached with the needle. Spinelli used this same method, with the addition of an anterior colpotomy; through this opening, reposition was facilitated and the incision in the uterus could be sutured after reduction of the inversion. In either the anterior or the posterior colpohysterotomy, if the incision is extended throughout the entire length of the uterus, the whole procedure of incising the uterus, reducing the inversion, and suturing the uterine incision usually is done wholly within the vagina; afterwards, the uterus is put back into the pelvic cavity through the colpotomy incision.

Hysterectomy may be done on account of one or more of the following indications:

1. Marked infection. This is the most common valid reason.

2. Gangrene. (Rare; three cases are reported, by Hutson, Steele, and Mériel.) Here, of course, hysterectomy is imperative.

3. Tumors: *a.* Malignant (Thorn has found 6 such cases, 4 sarcomata and 2 carcinomata); *b.* Benign tumors involving a large part of the uterus

4. In chronic inversions past the menopause, for the same reasons that a hysterectomy might be done at this age for a marked prolapse without inversion.

5. Instances where reposition is impossible. This indication ought to be exceedingly rare.

6. Weiss (1912) considers hysterectomy "the method of choice in chronic inversions of puerperal origin." This extreme position seems to the writer to be entirely unjustifiable

Of course, the vaginal route should be chosen in cases of infection or gangrene. In the cases of inversion with tumors, the inversion usually is of secondary importance, so that the treatment is determined mostly by the nature, size, position, etc., of the tumor, a discussion of which is not pertinent here. There have been several cases recorded in which hysterectomy was done for the sole reason that reduction could not be accomplished (Josephson, Hoover, etc.). For these instances the writer suggests a combination of procedures which, as far as he knows, has never been tried, namely, both anterior and posterior colpohysterotomy. Incise the cervix on both sides and extend one or both incisions as far as necessary

toward the fundus. Then, with the fingers of both hands passed through the colpotomy incisions, onto the doubly divided cervix and with the thumbs of both hands on the portion of the fundus which remains undivided, it seems that the most ancient and intractable case ought to be overcome so that there would be no excuse for removing a uterus on account of inversion alone

In regard to the safety of the various operative methods in acute inversions, the following statistics collected by Thorn are very instructive:

Kind of Operation	No. of Cases	Per cent Mortality
Laparotomy	24	21
Vaginal Hysterectomy		
Total	28	7
Partial	26	4
Colpohysterotomy		
Posterior	42	0
Anterior	8	0
Total No. Cases	128	
Av. Mortality		6

Among the laparotomies, there were five failures of reposition. These together with the high mortality speak strongly against this method. Considering especially the safety of colpohysterotomy and also its efficiency and the relative ease with which it may be done, one is not justified in making prolonged efforts at manual reposition or in trying repositors for more than a few hours. In all acute cases, simple manual reposition should be tested first; and usually it will succeed. In chronic cases it may be tried, and sometimes success will ensue, especially if some modification is used (Courty, Tate-Dandridge, etc.).

In using the method of colpohysterotomy, one should make only the cervical incision (Fig. 6) or the incision in the corpus (Fig. 5) at first, and then attempt reduction. In case the lesser incision fails, prolong it as far as necessary, making the complete incision (Fig. 7) or even both anterior and posterior incisions if necessary.

In a few instances, on account of a small vagina or a large uterus or a large tumor, etc., it is best or even imperative that one select the abdominal route.

In incomplete inversions operative treatment is seldom required for the inversion itself. One does have to operate, however, on

the concomitant tumor, which usually is the causative agent in these instances.

The following statistics from Thorn show the relative frequency with which various operative procedures are employed in cases of inversion caused by myomata.

Spontaneous separation of myoma	3 cases
Enucleation of myoma	35 cases
Amputation of uterus	19 cases
Total vaginal hysterectomy	14 cases
Combination of methods	3 cases
Unoperated	3 cases
Total No. cases	77

In the 35 cases in this table in which enucleation of the tumor was accomplished, the treatment of the inversion was as follows:

Spontaneous reposition	14 cases
Manual reposition	10 cases
Colpurynter	4 cases
Tamponade	3 cases
Kustner's operation	1 case
Reduction by laparotomy	1 case
Unreduced (one complete, one partial)	2 cases
Total No. cases	35

Of the 19 cases in which the corpus was amputated, in three instances reposition of the cervical stump was spontaneous. Thus we see the importance of spontaneous reduction in this class of cases, especially in instances of simple enucleation of the tumor, where its frequency is 40 per cent.

The treatment of inversion by surgical methods occupies such a large place in the literature that one is apt to acquire an exaggerated idea as to the number of cases in which it is indicated. Probably at least 75 per cent of all inversions are treated best by manual reposition and other non-cutting procedures, but in the relatively small number in which operation is necessary, the need for it usually is very urgent.

#### TREATMENT OF THE PLACENTA

There is considerable disagreement in regard to this subject. Dudley, Ashton, Thorn, and many others advise removal of the placenta before reposition, while Murphy and Lynch, Barrows and others replace the uterus without previous separation of the placenta, chiefly, they maintain, in order to avoid hemorrhage. Still others assume an intermediate

position, namely, removal if it is partly detached or reposition with the uterus if it is still entirely adherent. Byford, many years ago (1873), advised this course. Here, again, the main key to the situation is the contraction of the cervix.

#### Reasons for replacing placenta:

1 To avoid hemorrhage, especially in extreme uterine relaxation—a very important point. Boyd, however, describes a case in which the hemorrhage "became alarming and continued until the placenta was detached."

2 To avoid loss of time. If the placenta is adherent, enough time may pass so that a relaxed cervix may contract and thus make reduction difficult or impossible. This is a valid reason.

#### Reasons for separating placenta before reposition:

1 If adherent, it may be much more difficult to remove after reposition—a demonstrated fact (Fraser).

2 The placenta, by its bulk and unwieldiness, may prevent reposition if the cervix is contracted, this has occurred several times (McGlinn).

3 By its weight the placenta may cause reinversion (McGlinn), especially if the cervix remain relaxed.

4 Since the placenta is the portion of the descending mass which comes down farthest, often protruding outside the vulva, it is more likely to become contaminated. Hence, if possible, avoid placing it back inside the uterus. This is a very important consideration.

The majority of those who have actually treated cases of obstetrical inversion have separated the placenta before attempting reposition and they hold that usually this is the best course to pursue. Thorn says that "reposition of the placenta would be indicated only when the placenta is completely adherent when also there is no hemorrhage, and when further it is impossible to apply constriction at the isthmus to control hemorrhage—a combination of circumstances which would occur very rarely." Thorn's position is somewhat extreme. On the whole, replacement of the placenta seems to be allowable if

it is not contaminated with infectious material and if the cervix is not contracted.

#### SUMMARY

1. *Etiology.* In obstetrical inversion, the primary cause is uterine relaxation. The chief secondary factors are pressure on the fundus and traction on the cord. In inversion not obstetrical in origin, uterine fibroid is almost the exclusive cause.

2. *Pathology.* Most cases are both acute and complete; in the complete ones, the most important point is the degree of contraction of the cervix. In inversion of gynecological origin the causative tumor is of pre-eminent importance.

3. *Symptoms.* In acute cases, the cardinal symptoms are hæmorrhage, shock and pain. Later, the manifestations of a complicating infection may appear. In chronic inversion, the symptoms are those of marked uterine prolapse plus those of menorrhagia and metrorrhagia.

4. *Diagnosis.* This is made from the objective findings exclusively. In obstetrical inversions, it is almost always very easy. Vaginally, a large, soft, pear-shaped, bleeding tumor is found, with the placenta attached in about half the cases. Abdominally, no corpus is found, and in its place there is a cup-like depression. In gynecological cases, the diagnosis of inversion due to a fibroid frequently is very difficult. The chief points are first, the shortening of the uterine canal produced by inversion as compared with the lengthening caused by a fibroid; and secondly, the indentation produced by the inversion on the peritoneal surface.

5. *Prognosis.* The mortality in acute cases in recent years has been about 35 per cent; in chronic ones, about 6 per cent.

6. *Treatment.* In all acute and in most chronic cases, manual reposition should be tried. In most of the former, if undertaken early, and in many of the latter, this procedure is successful. If it fails, repositors, etc., may be used, but only for a short time. If these are unsuccessful, one should resort at once to some operative method, the one of choice being colpohysterotomy. This operation stands pre-eminent in the treatment of

difficult cases of uterine inversion, on account of the facility of its performance and its success in accomplishing the reduction of the inversion, and also because of the practically complete absence of any mortality. The uterine incision should be made at first through the cervix only, and later be extended as far into the corpus as necessary to accomplish reposition. In inversion due to tumor, the treatment is mostly that of the causative fibroid. After this is removed, if the uterus still remains, in about one third of the cases spontaneous replacement occurs, while in the other instances reduction is accomplished usually without difficulty by non-operative methods.

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1 Thorn's largest and most important publication on this subject

## THE PATHOLOGY OF UTERINE CASTS PASSED DURING MENSTRUATION

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IN January, 1912, I showed before the Gynecological Section of the Royal Society of Medicine<sup>1</sup> two somewhat unusual uterine casts passed during menstrual periods by a married woman aged 32. These specimens very much resembled abortions, both in their macroscopical and microscopical appearances; but as I had removed the patient's tubes some two years previously there was strong presumptive evidence against pregnancy.

I brought forward these specimens for the purpose of provoking a discussion on the pathology of menstrual casts, since there are many who still adhere to what I regard as an untenable view, namely, that all endometrial menstrual casts are the result of conception. The discussion<sup>2</sup> tended to emphasize this point of view. I therefore showed a further series of specimens before the Society last July<sup>3</sup>. The general opinion then expressed in the discussion coincided with mine, namely, that while there is a decidua-like reaction, it cannot be mistaken for the true decidual reaction of pregnancy.

I have thought it worth while, therefore, to publish an account of this further series of specimens which I have obtained in the last six months. I hope to prove, once and for all, that the idea that menstrual endometrial casts are all the products of conception is an entirely erroneous one, although of course abortions do occur and may sometimes be confused with menstrual casts by those who are unaware of the histological differences.

In order to make the communication more or less complete, I propose to discuss all forms of menstrual casts. These may be

1. True blood casts of the uterus,
2. Endometrial casts.
  - (a) Thick casts,
  - (b) Thin casts.

I do not believe any other form of menstrual cast exists.

1 *True blood casts of the uterus.* One or more of these may be passed during a menstrual period. The specimens shown in Fig. 1 were all expelled at the same menstrual period, during which there was considerable bleeding. The patient was a married woman about 45 years of age, and she had had menorrhagia for three months. The pathology of this condition is not difficult to understand.

As I have previously stated,<sup>4</sup> and hope shortly to prove more fully, menstrual blood does not clot normally, because the fibrinogen and fibrin ferment are extracted by the endometrium. When, however, the endometrium is unhealthy and fails to extract the ferment, or when the flow is so great that the blood passes through the endometrium too quickly for the extraction of the ferment to be effected, then in either case clotting of the menstrual blood may take place in the uterine cavity. The expulsion of the clots leads to dysmenorrhœa, as I have pointed out elsewhere.<sup>4</sup>

These blood casts of the uterus are therefore merely retained clots which have been moulded into the shape of the uterine cavity. Histologically they are seen to consist of blood clot only (Fig. 2).

2 *Endometrial casts* may be thick or thin, and they are usually passed in two separate portions.

(a) *Thick casts.* Such specimens (Figs. 3, 4 and 5) are not common, and they are certainly the most difficult to distinguish from abortions. But I think that the histological appearances of these casts do not resemble those of the ordinary true decidual cast of pregnancy so much as is usually thought. The specimens were passed by a woman whose tubes I had previously removed. She expels them almost every month; and, as will be seen from the illustrations, they are some-

<sup>1</sup>Proc. Roy. Soc. M. Feb. 1912, p. 153.  
<sup>2</sup>Proc. Roy. Soc. M. Feb. 1912, p. 156.  
<sup>3</sup>Proc. Roy. Soc. M. July 1912, p. 321.

<sup>4</sup>The Principles of Gynecology, 1912.



Fig 1 (above) Menstrual blood casts of the uterus  
Fig 2 Section of Menstrual blood cast

what variable in macroscopical appearance. The membranes themselves are thick. If not rolled up they are smooth on the surface lining the uterine cavity and shaggy on the surface that has been detached from the uterine wall. Their thickness depends entirely on the fact that practically the whole thickness of the endometrium has been detached. The third specimen (Fig 5) is very small and consists of rolled-up pieces of tissue. I have recently obtained a fourth cast from this patient, which is similar in macroscopic appearance to that shown in Fig 4. The microscopical appearance, however, is the same in each case (Figs 6, 7 8 and 9).

There is a decidua-like change in the cells of the stroma and those lining the glands, but this decidua-like change differs from the decidual change of pregnancy chiefly in the size and shape of the cells. Further, there is



Fig 3 (above) Thick menstrual endometrial cast from same patient as the one shown in Figs 4 and 5  
Fig 6 Section of cast shown in Fig 3

marked effusion of blood serum among the cells which gives rise to a ground glass appearance in the stroma. This is not seen in the decidua of pregnancy (Fig 10).

In all these menstrual membranes it is usual to find a certain amount of degeneration, which is proportionate to the length of time they have been retained before being passed and fixed in preservative fluid. Sometimes the degeneration or maceration is so advanced as to make histological investigation and photomicrography difficult.

(b) *Thin casts* These casts are more readily admitted by many to be menstrual rather than conceptional in origin, although there are still those who believe that these membranes also are the result of pregnancy. Four specimens from two patients are illustrated (Figs 11, 12, 13, and 14).

Both women were married. The one from whom specimens shown in Figs 11 and 12



Fig 4 (above) Thick menstrual endometrial cast from same patient as those shown in Figs 3 and 5

Fig 7 Section of cast shown in Fig 4



Fig 5 (above) Small thick menstrual endometrial cast From same patient as those shown in Figs 3 and 4

Fig 8 Section of cast shown in Fig 5. Incidentally the folding of the membrane on itself to produce a solid cast is shown

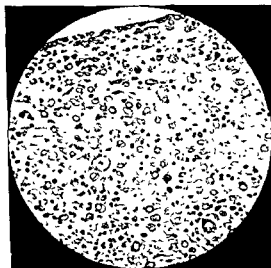


Fig 9 Section of fourth menstrual cast from the patient from whom casts shown in Figs 3, 4 and 5 were obtained

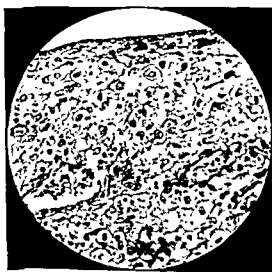


Fig 10. True decidual cast (abortion) Compare with Figs 6, 7, 8 and 9



Fig. 11 (above) Thin menstrual endometrial cast From same patient as that shown in Fig. 12

Fig. 15 Section of thin endometrial cast shown in Fig. 11

were obtained commenced to pass them only after her second marriage. The specimen shown in Fig. 12 was obtained after a test separation, if the statement of the patient can be relied upon. The patient from whom specimens 13 and 14 were obtained was the wife of a doctor who has given me the fullest particulars of her case. Knowing the common supposition with regard to pregnancy, he assures me that these membranes are passed subsequently to a test separation just as at other times. Another interesting feature connected with this last case is the fact that the two sisters of the lady in question also pass similar membranes every menstrual period. They are both unmarried. A breakage in the post robbed me of the opportunity of investigating membranes passed by the two sisters

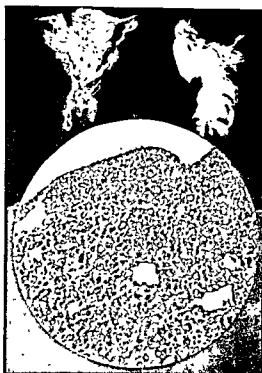


Fig. 12 (above) Thin menstrual endometrial cast from same patient as Fig. 11

Fig. 16 Section of thin endometrial cast shown in Fig. 12

Sections of these thin endometrial casts show in every instance that there has been a decidua-like change in the stroma cells (Figs 15, 16, 17 and 18). Of course when the membrane is as thin as some of these are, degeneration takes place very rapidly and the decidua-like reaction is not always easy to photograph; but if careful histological examination of the sections be made, no doubt can be left in the mind of the observer as to the character of the change.

Cuthbert Lockyer's statement that in his experience "the cells in menstrual endometrial casts were small, shrunken and branching, the stroma was formed of a slender adenoid reticulum,"<sup>1</sup> cannot in my opinion be accepted as representing the typical microscopical appearance seen in these specimens. That description applies to the normal endometri-



Fig. 13 (above) Moderately thin menstrual endometrial cast From same patient as that shown in Fig. 14.

Fig. 17 Section of thin endometrial cast shown in Fig. 13.

um in the 'resting' stage of the menstrual cycle.

From the above description it will be seen that there are two forms of menstrual casts from the uterus, the 'blood cast' and the 'endometrial cast'. With regard to the differences in the thickness of the latter, I believe this to depend solely on the depth of the endometrial denudation. The menstrual decidua-like reaction which, as already pointed out, can be seen in the sections, prevents the blood from breaking through easily, consequently the menstrual hæmor-



Fig. 14 (above) Moderately thin menstrual endometrial cast From same patient as that shown in Fig. 13.

Fig. 18 Section of thin endometrial cast shown in Fig. 14.

rhage strips up the superficial portion of the endometrium instead of passing through it. This may lead to a considerable portion of the endometrium being stripped off (thick membrane) or to denudation of the superficial layers only (thin membrane). Either type of membrane may become rolled up and form a so-called 'solid' endometrial cast (Figs. 5 and 8) when retained long enough in the uterine cavity.



# NOTES OF CASES ILLUSTRATING SOME OF THE SURGICAL ASPECTS OF PERSISTENT MECKEL'S DIVERTICULUM

WITH REMARKS AND A RECORD OF TWENTY-TWO CASES

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ON reviewing the surgical records of the Royal Victoria Infirmary from 1900 to May, 1912, I found no less than 22 cases of acute abdominal disease resulting from a persistent Meckel's diverticulum. These cases are all of interest because they illustrate the majority of dangers for which this remnant of the omphalo-mesenteric duct is responsible.

At the pathological meeting of the Northern Division of the British Medical Association in the summer of 1910 I showed a series of Meckel's diverticula removed either by operation or obtained from the post-mortem room, and drew attention to different varieties and to the dangers which each particular type was likely to occasion.

The accompanying table, though incomplete, shows that, speaking generally, a certain type of diverticulum is responsible, when harm arises from it, for a definite and specific lesion, e.g., a Meckel's diverticulum of unusual length (6 or 8 inches) will cause intestinal obstruction, and may be inflamed or strangulated as the result of interference with its blood supply by a loop of implicated small intestine.

Again, a diverticulum adherent to the umbilicus, by acting as a band, may cause strangulation of the small intestine or produce a secondary volvulus.<sup>1</sup>

Or, diverticula of the small cone-shaped variety may become inverted into the bowel and produce intussusception. These have their broad base at their proximal end, and when examined in the recent state the mucous membrane at the base is usually found to be lax. It has been shown that at an early stage this lax mucosa only may be prolapsed into the small intestine from which the diverticula spring, and that, acting like a

prolapsed pile, this in its turn may produce hæmorrhage and pain.

Since recording six cases of inverted Meckel's diverticula which caused intussusception<sup>2</sup> two more have occurred in the Royal Victoria Infirmary, Newcastle-upon-Tyne, making 7 per cent of all cases of intussusception admitted from 1900 to June, 1912. One of these, which came under the care of Mr. Turner, is of special interest since it illustrates the fact that frequent attacks of pain may occur before the diverticulum is completely inverted into the bowel and the accompanying intussusception is produced.

The patient, a clerk aged 34, was admitted to the hospital on January 22, 1912, with a history that in August, 1911, he began to have attacks of abdominal pain accompanied by loud rumblings and sometimes diarrhoea, though no blood was ever found in his stools.

In November, 1911, the attacks became more pronounced and he was obliged to take to bed for several weeks. The attacks of pain recurred from time to time, and about a month before admission he vomited, and a week before admission the vomit contained some altered blood, but there was no mæna. For three days before admission he vomited incessantly and complained of great pain coming on in spasms. The bowels acted regularly and there was a tendency to constipation.

On admission he looked very ill and wasted, pulse 128, temp 98°. The abdomen was distended, but not markedly so, and no intestinal movements could be seen. Rectal examination was negative. An enterostomy was performed by Mr. Turner, but no further exploration of the abdomen was made on account of his general condition. He died two days later from toxæmia.

On post-mortem examination an intussusception of the small intestine was found, the apex of which was formed by a Meckel's diverticulum about 3 inches in length. The distal end of the diverticulum was bulbous and gangrenous (Fig. 2).

<sup>1</sup> For classification of volvuli of intestine see 'Introduction to surgery' by Rutherford Morrison p. 126.

<sup>2</sup> Ann. Surg., Phila. March 1912.



Fig. 1 A Meckel's diverticulum which contained a calculus. The distal end was bulbous and formed an abscess cavity. It was covered over by adherent omentum which prevented rupture of the abscess into the general peritoneal cavity (calculus natural size)

Although the pathological conditions resulting from a Meckel usually conform more or less accurately with one of the above types, there may be complications a fact which is illustrated by a case admitted into the Royal Victoria Infirmary under the care of Mr Martin in December, 1909.

The patient had intestinal obstruction, complete gangrene of the terminal portion of the Meckel due to strangulation of its blood supply, and an abscess cavity surrounding the gangrenous perforated diverticulum in which a calculus was found.

D. H., male, aged 27, whose history was as follows.

Eight days before admission he was seized with a sudden pain in the abdomen just below the umbilicus whilst taking his midday meal. He was obliged to go to bed, and hot applications were applied to the abdomen but without relief as the pain recurred in paroxysms about every twenty minutes. Two days later he vomited dark green, bile-stained material and the pain and vomiting continued up to the time of admission.

When admitted his general condition was good, his tongue was moist and red, pulse 86 temp 98.4°. He complained of paroxysmal abdominal pain. On inspection the lower abdomen was somewhat distended. No peristaltic movements could be seen. On palpation a distinct mass could be felt below and to the left of the umbilicus tender on light pressure.

On December 17, 1909, Mr Martin explored the abdomen by a middle line incision below the umbilicus. An abscess was found just to the left of the umbilicus in contact with the anterior belly wall. Coils of small bowel and a portion of the omentum surrounding it formed the abscess walls. In the center of the abscess lay the distended distal end of a Meckel's diverticulum, which was gangrenous and perforated, allowing the escape of a small calculus into the abscess cavity. Several of the surrounding loops of small intestine were greatly distended and obviously obstructed. The abdomen was packed off, the Meckel's diverticulum was exposed, ligatured at its base, and excised, along with an adherent portion of great omentum, and the stump of the diverticulum was inverted into the intestine by a purse-string suture of catgut.

A gauze drain was placed in the affected area and the abdomen was closed in layers by catgut. The patient made an uninterrupted recovery and left the hospital well and healed on January 11, 1910.

*Description of specimen (Fig. 1)* The diverticulum was 4 inches in length. The distal end was distinctly bulbous, forming a cavity that would hold a pigeon's egg. The



Fig. 2 A Meckel's diverticulum which has become inverted into the bowel. It formed the apex of an intussusception of the small intestine, which has been reduced.

wall of this portion was surrounded by omentum except at the point of rupture (in the drawing this has been removed), where it was merely formed by the thin gangrenous coat of the diverticulum. The proximal end communicated with the distal portion by a narrow channel  $\frac{1}{4}$  inch in diameter. The distal end of the diverticulum, in the ordinary state, contained a flat calculus  $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{4}$  inches. The surface of this was smooth, non-faceted, of firm texture, and dark brown in color. It weighed 12 grains, and Prof. Bainbridge, who kindly made an analysis, reported it to consist of inspissated fecal matter containing bile pigment.

The differential diagnosis of the most common lesions produced by Meckel's diverticulum, viz., peritonitis and obstruction is difficult, because either condition may be produced by other causes the most common being a diseased vermiform appendix, and the pathology of these lesions whether occurring in connection with Meckel's diverticulum or appendix, is the same. Both may suffer from attacks of inflammation varying in degree from catarrh to gangrene, and either may cause intestinal obstruction, though in the case of the appendix obstruction is nearly always due to a kink in a loop of small bowel entering into the formation of an appendicular abscess, and is consequently secondary to an inflammatory lesion primary in the appendix, whereas in the case of the Meckel's diverticulum obstruction is often the primary lesion and changes in the Meckel itself secondary (strangulation, inflammation gangrene).

An example of an appendix causing obstruction was admitted into the Royal Victoria Infirmary under Mr. Clay in April, 1909.

The patient a boy aged 10 had acute intestinal obstruction. A long appendix had become wrapped round a loop of small intestine causing strangulation of the bowel. The swelling of the distended loop interfered with the blood supply of the appendix so that the tip of it was quite gangrenous.

But this train of events, as has already been stated is comparatively rare.

The difficulty attending the differential diagnosis of acute abdominal lesions caused

by Meckel's diverticula from those associated with the appendix vermiformis is plainly shown in cases 20 and 21 of this series.

The subject of case 20 was a male aged 55 who was admitted into the Royal Victoria Infirmary on September 7, 1911, under the care of Mr. Richardson. He was seized with pain in the right side of the abdomen with vomiting 13 days before. The symptoms subsided and he felt better until three days before admission, when the pain returned in the lower part of the abdomen.

On admission he looked ill, temp. 99° pulse 100. The abdomen was tender and rigid in the right iliac fossa where there was an indefinite mass. A diagnosis of acute appendicitis was made.

At the operation a small normal appendix, 2 inches long was found. A small Meckel's diverticulum was also discovered, with its distal end adherent and gangrenous but not perforated. This was removed and the patient went home well on September 18, 1911.

The other case No. 21, is also of interest. A young man aged 19 was admitted into the Royal Victoria Infirmary on March 1, 1912, under the care of Mr. Martin with the history that ever since his appendix had been removed six years before he had been subject to attacks of abdominal pain in the region of the appendix. At about 5 o'clock on the previous evening he had been seized with severe pain which was referred to the umbilicus. He felt very ill and vomited frequently up to the time of admission.

On admission his pulse was 132 thin and thready, and he looked very ill. The abdomen was distended and there was no flank dullness. The liver dullness was present.

Mr. Leach who saw him operated and found a Meckel's diverticulum 4 inches in length. The terminal end was bound down in the pelvis, and a band which extended from the bulbous end of the Meckel to the ileum a short distance above its origin was the cause of acute intestinal obstruction. After the obstruction was relieved it was found necessary to resect the Meckel and adjacent loop of small bowel. This was done and a lateral anastomosis made.

Many cases of acute Meckelitis operated upon for appendicitis have been recorded, to a few of which I may briefly refer.

Sherrin<sup>1</sup> reports a case of his own occurring in a man aged 38, who for two and a half years had suffered from attacks of pain in the right iliac region. A diagnosis of appendicitis was made and at the operation a mass was felt containing calculi, which was thought to be gall bladder but which turned out on exposure to be a Meckel's diverticulum, which in the recent state measured 4½ inches in length, and presented at a point about 1 inch from

<sup>1</sup> Royal Society of Medicine Nov. 1906.

the proximal end a definite constriction, formed by a fold of mucous membrane. Beyond this point the diverticulum contained many small black calculi composed of cholesterin, calcium oxalate, and a trace of bile pigments. It was removed, and two years later the patient was well and free from attacks of pain.

It was thought that these calculi were formed in the diverticulum as the result of inflammation of its mucous membrane, and the fact that the neck of the diverticulum was too small to admit the passage of the greater number of the calculi confirms this view.

Hollander<sup>1</sup> reported a case of a man operated upon ten hours after the onset of an attack of abdominal pain that was supposed to be due to appendicitis. The operation, however, revealed a gangrenous Meckel's diverticulum full of calculi which were thought to be gall-stones. The diverticulum was removed and recovery followed.

Oliver Smith,<sup>2</sup> in a paper dealing with abdominal crises caused by Meckel's diverticulum, records two cases of his own, in one of which appendicitis was diagnosed and a gangrenous Meckel found at operation.

Todd,<sup>3</sup> writing on the same subject, states that in his experience a Meckel is frequently the cause of abdominal lesions, and that it may give rise to all the urgent symptoms of acute appendicitis. He remarks: "We are all familiar with cases of recurrent abdominal pain, with distention and tenderness, which have been diagnosed as relapsing appendicitis. Our diagnosis has not perhaps been made as certainly as we could wish. In spite of the acuteness of the pain and the urgency of the symptoms, the pulse is often hardly quickened at all and, more disconcerting still, the temperature does not rise. At the operation the appendix is found normal, or almost normal, but to remove it is a safe thing to do, and the hope is expressed that the cause of the disturbance is removed, not infrequently, though, the pains recur as before. This is the class of case in which I think very often the diverticulum is in one of the ways I will presently mention the cause of the symptoms."

Along with cases of his own he records particulars of one of some interest that occurred in the practice of a colleague.

The patient, a boy aged 10, had an acute abdominal attack. The pain was most marked in the appendix region. The appendix, which was not obviously diseased, was removed. On the day following the operation he was worse. The abdomen was again opened and a long Meckel's diverticulum, the vessels of the mesentery of which were thrombosed, was found knotted round a large coil of ileum. In this case no doubt obstruction occurred first and later gangrene of the Meckel, due to the increasing congestion of the loop of small intestine involved.

He also records two similar cases which occurred in his own practice.

There are many cases of inversion of the appendix into the cæcum on record, and, as we know, some of these have been responsible for an intussusception of the cæcum.

Both diverticula and appendices may contain calculi. As stercoliths they are more frequently met with in the latter, but they are capable of giving rise to similar symptoms and of producing the same pathology. The poor blood supply of a Meckel's diverticulum probably renders it more liable to gangrene than the more richly supplied vermiform appendix, and it is quite common to meet with Meckel's diverticula in which the distal end is bulbous, thin-walled, and without the good vascular supply which the remaining portion often possesses.

Sometimes an abdominal lesion due to Meckel's diverticulum is suggested by the discovery of some abnormality at the umbilicus. Treves<sup>4</sup> states, for example, that a congenital hernia is not infrequently present, and other abnormalities of the umbilicus are recorded, from a mere tucking in to definite fistula.

Bidwell<sup>5</sup> operated upon a case of intussusception of the ileum due to an inverted Meckel's diverticulum in a boy aged three on whom he had previously operated for a congenital hernia at the age of one year.

Gray<sup>6</sup> operated upon a case of intussusception of the ileum due to an inverted Meckel's

<sup>1</sup> Quoted by Sherren. Royal Society of Medicine, Nov., 1900.

<sup>2</sup> Ann. Surg., Phila., Nov., 1904.

<sup>3</sup> Australasian Med. Gaz., Dec. 20, 1911.

<sup>4</sup> System of Surgery, vol. II, Page 727.

<sup>5</sup> Lancet, Sept., 1907.

<sup>6</sup> Ann. Surg., Phila., Dec., 1908.

No. of Case	Lesion caused by Meckel	Sex	Age	Time from birth	Previous attack	Operation	Result	Type of diverticulum	Umbilical excreta
1	Intestinal obstruction	Male	7	6 days	No note	Enterostomy	Death	No note	No note
2	Inversion of Meckel causing intussusception of small bowel	Male	25	3 days	Previous attacks for several months	Resection of intestine Meckel	Recovery	4 inches in length	No note
3	Inversion of Meckel causing intussusception of ileum	Male	5	1 day	No note	Reduction of intestine, removal of Meckel	Recovery	Cone shaped Meckel broadened at base 1 1/2 inch in length	No note
4	Strangulation of small intestine	Male	1/2	2 days	No note	Resection of gangrenous gut including Meckel's diverticulum anastomosis	Death	Adherent at its apex to the umbilicus	No note
5	Acute intestinal obstruction of ileum and perforation of Meckel causing septic peritonitis	Male	4	5 days	No note	None	Death	No note	
6	Acute intestinal obstruction of ileum from a fibrous band around a Meckel which itself was completely obstructed and gangrenous	Male	8	2 days	No note	Removal of gangrenous Meckel and adhesions relieved	Death	Small narrow Meckel 2 1/2 inches in length adherent at its apex	
7	Inversion of Meckel causing intussusception of small bowel	Male	11	5 days	No note	Resection of intussusception including Meckel	Death	Small cone-shaped Meckel 2 1/4 inches in length with broad base	Marked in two rings of ganglionic excreta
8	Acute intestinal obstruction of loop of ileum the Meckel acting as a band	Male	13	4 days	Attacks of pain and vomiting coming on every 6 months for 8 years	Removal of Meckel's diverticulum	No note, Death	Meckel 6 inches in length and tapered to a cord at its distal end which adhered to umbilicus	No note
9	Meckel looped over small gut causing obstruction Meckel itself was completely gangrenous	Male	10	1 wk	None	Removal of Meckel's diverticulum	Death		No note
10	Meckel became obstructed and calcified containing calculus intestinal obstruction	Male	27	8 days	None	Removal of Meckel and calculi drainage of abscess	Recovery	5 inches long in recent state narrow proximal end	No note
11	Meckel producing acute intestinal obstruction of small bowel	Male	21	No note	No note	Enterostomy and removal of Meckel's diverticulum	Death	No note	No note
12	Strangulation of the small intestine over a Meckel adherent to the umbilicus	Male	11	1 day	None	Removal of Meckel	Death	6 inches long and attached to the umbilicus	No note
13	Distal extremity of Meckel gangrenous had ruptured also acted as a band causing intestinal obstruction	Male	31	1 day	No note	Removal of Meckel enterostomy	Death 3 days later	Well developed Meckel with thin bulbous extremity which was perforated	No note
14	Acute intestinal obstruction	Male	20	1 day	None	Resection of small gut and Meckel's diverticulum anastomosis end to end anastomosis of small bowel	Recovery	No note	No note
15	Intussusception of small gut due to inversion of Meckel's diverticulum	Female	5	7 days	Several first noticed 12 months previously	Removal of Meckel	Death	Cone shaped 3 1/2 inches in length contained an accessory pancreas	Scars indrawn
16	Strangulation of loop of small intestine around a Meckel which was adherent to umbilicus	Female	11	1 day	None	Resection of loop and Meckel and end to end anastomosis	Death next day	Well developed about 4 inches in length and adherent to the umbilicus	Healed scar at umbilicus
17	Inversion of Meckel producing intussusception of small bowel	Male	20	2 days	Several	Resection of loop of small bowel containing Meckel	Death	3 1/2 inches in length mucous membrane at base very lax club-shaped distal extremity	Large and protuberant

No. of Case	Lesion caused by Meckel	Sex	Age	Duration of attack	Previous attack	Operation	Result	Type of diverticulum	Umbilical cicatrix
18	Meckel producing obstruction of small intestine	Male	19	5 days	None	(1) Enterostomy (2) Resection of small gut containing Meckel	Recovery	Small cone-shaped, adherent to the mesentery of the small bowel	Considerably indrawn
19	Inversion of Meckel's diverticulum causing intussusception of small bowel	Male	8	1 wk	No note	Laparotomy, resection of loop of bowel containing Meckel	Death	Small bulbous diverticulum 2 inches in length	Normal
20	Gangrene of Meckel's diverticulum	Male	55	1 day	No note	Laparotomy, removal of Meckel and drainage of belly cavity	Recovery	Small Meckel 2 inches in length	No note
21	Loop of small intestine adherent to old inflamed Meckel in pelvis causing acute intestinal obstruction	Male	19	1 day	Pain in appendix region for 6 years. When removed contained thread worms	Removal of Meckel and adjacent loop of small intestine	Death	4 inches in length well developed the terminal end was thin and bulbous	No note
22	Inversion of Meckel's diverticulum causing intussusception of small bowel	Male	34	3 mos	Attacks extending over 6 months before final attack	Enterostomy	Death	3 inches in length, gangrenous reduction impossible owing to inversion being of old standing	Normal

diverticulum. He observed the umbilicus to be raised and dome-shaped and the overlying skin to be of a bluish tint and considerably scarred. A somewhat similar condition was met with in cases 16 and 17 of the appended series. The umbilical cicatrices were large and dome-shaped, but discoloration and scarring were absent. In Case 14 there was pronounced puckering of the umbilicus, and this was also noticed in Case 6, but the sign was not observed until after death.

The lesions produced by Meckel's diverticulum may be considered under three headings:

1. Different forms of intestinal obstruction and strangulation caused by its action as a band, or by some acquired change in its position and the formation of a loop, or acting as a pedicle in the development of a volvulus; and the production of an intussusception of the small intestine.

2. Inflammatory lesions, with the resulting changes ranging from a catarrhal condition of the mucosa to complete gangrene of all the coats.

3. Some unusual forms, e g., when a diverticulum, closed at both ends, forms an enterocyst, or the presence of calculi gives rise to attacks of pain like appendicular colic, gallstones, hernia, etc.

The accompanying table shows that, of the 22 recorded cases, intestinal obstruction due alone to acquired adhesions occurred in

6 instances, in 2 there was strangulation of the small gut over a Meckel's diverticulum which was adherent to the umbilicus; in 7, intestinal obstruction resulted from inversion of the diverticulum, producing intussusception of the small bowel, and in another the diverticulum remained attached to the umbilicus, causing a secondary volvulus of the lower ileum, cæcum and ascending colon. In the remaining 6 cases there was evidence of inflammatory changes in the diverticulum. Three of them had perforated and caused peritonitis, and those remaining showed gangrene without perforation.

Of the 3 cases in which gangrene had occurred with perforation, 2 were associated with intestinal obstruction, which was the primary factor leading to arrest in the circulation of the diverticulum; while in the third, acute inflammation alone was present.

A primary acute diverticulitis is a rare occurrence. a case is recorded by Gray<sup>1</sup> in which neither torsion of the diverticulum nor intestinal obstruction was present.

In Case 15 there was a healed sinus at the umbilicus, which had previously discharged.

On the other hand, I may mention that I have frequently found the umbilicus raised or indrawn in subjects dead from other causes, where no Meckel's diverticulum was present. But with symptoms of an acute abdominal attack, this sign may be held to

be suggestive of the diagnosis of a Meckel's diverticulum, though it cannot be regarded as conclusive.

#### CONCLUSIONS

1. A persistent Meckel is a decided source of danger

2. The definite lesion resulting from it is largely determined by its anatomical form; e. g., small Meckels with broad bases are most likely to cause intussusception.

3. Owing to the rarity of Meckel's diverticulum (2 per cent in bodies examined), acute

inflammatory lesions resulting from it are necessarily uncommon.

4. The symptoms may be precisely similar to those that arise in connection with lesions of gall bladder, intestine or appendix. The pathology is practically the same, and the diagnosis may be impossible. The appendix is most commonly mistaken.

5. Changes at the umbilicus may aid in the diagnosis of a diseased Meckel.

I wish to thank the surgeons on the staff of the Royal Victoria Infirmary for allowing me to make use of their cases.

## ACUTE DILATATION OF THE STOMACH AND ITS TREATMENT

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AT the November meeting of the Christiania Surgical Society in 1907, a paper was read on the post-operative acute dilatation of the stomach, whereupon a lively discussion ensued. On reading through the report of the meeting one will notice that that side of the subject which aroused especial interest was the etiological, or in other words the purely scientific, question as to the still obscure origin of the disease. The practical side, the treatment, was, comparatively, only superficially referred to. The repeated use of the stomach tube was recommended, also rectal feeding, saline enemata or hypodermoclysis. All were agreed as to the early and repeated use of the stomach tube, both as a diagnostic remedy and as the most important therapeutic agent. That even this, however, is too often without avail was proved by the fact that of four mentioned cases of acute post-operative dilatation of the stomach treated in this way, two ended fatally. Several speakers implied, however, that they had seen lighter and quickly transient instances of this illness.

My experiences later aroused my interest in the acute dilatation of the stomach. It struck me as strange that a remedy suggested by Schnitzler — according to testimony an

extremely efficacious one — to let the patient lie prone in bed, was not mentioned during the discussion in our surgical society. Half en passant, the lecturer said, it is true, that knee-chest position had been tried during the after treatment, on account of the hypothesis that arterio-mesenteric compression may be the cause of an acute dilatation. Likewise, Kelling's suggestion to place the patient on his left side with elevated pelvis was mentioned. But Schnitzler's methodical procedure as the principal or only treatment was not brought forward. A closer acquaintance with the literature has taught me that this topic, when discussed, generally has been treated in the same manner as with us — the etiology has engaged the interest to the exclusion of the treatment.

With an illness so fatal as the acute dilatation of the stomach, contributions to the treatment can claim abundant space. An addition to the hitherto few examples of the effect of postural treatment seems specially to possess a considerable and dual interest. In the first place, it is of importance, on account of the treatment itself, to prove this effect, which is still denied by many. Secondly, the effect of the abdominal posture once proved beyond doubt, a new light is thrown

on the obscure etiology of the acute dilatation of the stomach. In this paper it is my object, primarily, to illustrate by my own cases the effect of the abdominal position in acute gastric dilatation. Secondly, I shall try, by a collection of the cases which have been published since the abdominal posture's first use in 1895, to put the different ways of treatment to the test. Finally, I use the striking effect of the prone position and the chief clinical characteristics of the acute gastric dilatation as arguments in the discussion of the etiological question. I have added two cases which were not treated with abdominal posture; this was done to publish known cases of this disease.

CASE 1. A. S., a widow aged 53, was admitted to Diakonhjemmet February 22, 1910, with a diagnosis of chronic appendicitis, discharged April 13. Family history good. Her present illness dates back two years. It commenced suddenly with an attack of pain in the abdomen, accompanied by vomiting and a soreness below the right costal margin. She got up again after three days, but felt unwell, was without appetite, and with any movement the pain revived in the affected part. This condition changed two days later quite as suddenly as her illness usually commenced, with a more violent attack than she previously had had. The pains had their seat in the whole of the abdomen, but perhaps most acute in the epigastrium, and were first alleviated, after 24 hours' duration, by an injection of morphia. An attack of pneumonia now kept her in bed for 16 days. In August, 1908, and during the last three weeks, she had had similar but somewhat slighter attacks, with two to three days in bed. Jaundice has never been noticed.

*Present condition.* The patient is a well-preserved, fairly stout woman, somewhat pale but with no appearance of an invalid. Kidneys and thoracic organs sound. Abdomen large but soft. Liver not enlarged, gall-bladder not palpable. Patient is tender below the right costal margin and in the caecal region. T, vesp., 36.4, P. 92.

*Operation.* Appendectomy and cholecystectomy were performed under scopolamin-morphin-ether. The appendix, which bore traces of an old pathological process, was removed. Thereupon the gall-bladder was excised. It was firmly connected with the duodenum and full of stones right up to the proximal end of the cystic duct.

One hour before the operation the patient was given subcutaneously  $\frac{1}{4}$  mgr scopolamin, and 40 minutes later 1 cgr. morphia and 1 ccm oleum camphoratum. The narcosis took place through an open gauze mask; patient became unconscious after 11 minutes, with a consumption of 30 ccm. ether. The narcosis lasted 2½ hours, was easy and without

complications of any kind, and was not followed by sickness, 240 ccm. ether were used.

Feb. 27.—T. 37.37.1; P. 100. Patient feels well, has slept fairly well. Appearance good. No vomiting since the operation. Allowed to drink water gruel and water. The urine has to be taken by catheter.

Feb. 28.—T. 36.9, 36.7; P. 92. Condition and appearance good. Flatus has been passed since yesterday morning. Patient has drunk about 100 ccm. water gruel in the last 24 hours, and on account of thirst a large amount of water, much more than usually permitted. Yesterday afternoon, without preceding indisposition, she vomited twice with half an hour's interval, a thin greenish fluid without odor. Since yesterday evening she has received saline enemata, which are still continued. The wound shows no reaction.

March 1.—T. 37.2, 36.8, P. 92. Patient still feels well, she drank 200 ccm. water gruel and a little water in the last 24 hours, without vomiting. Extreme thirst. Saline enemata 4 to 6 times daily.

March 2.—T. 37.1, 36.9, P. 96. During the last 24 hours she has drunk the same amount of gruel and water as before. She complained yesterday afternoon of heaviness and fullness in the chest, also a bitter taste. Four or five times in the course of the night she vomited small quantities of fluid similar to that of the day after the operation. She complains still of oppression and an intolerable thirst. During the morning visit, partly through an introduced stomach tube and partly by vomiting, about 1½ litres of thin, greenish fluid, which now has a nauseating odor, was emptied. The patient afterwards felt much better and easier, but excessively thirsty. Saline enemata are continued.

March 3.—36.9, 36.1, P. 104. In the last 24 hours she drank only 50 ccm. water gruel and very little water. During the evening visit yesterday, one litre was evacuated by the stomach tube. Notwithstanding the abundant supply of fluid through the rectum, her thirst is overwhelming. Flatus has been passed since the day after the operation. Yesterday evening the bowels moved spontaneously. Yesterday morning about ¾ litre of thin, greenish fluid was emptied by the stomach tube, it gave bile reaction.

At the evening visit the patient's condition is the same. The appearance is still fairly satisfactory, but she complains of fullness and unquenchable thirst, worse than ever. The abdomen has during the whole time been distended, mostly above the navel, but the distention now reaches to 8 to 10 cm. below the umbilicus, chiefly in the left side.

During the last two days I had not for a moment doubted that the case before me was one of post-operative gastric dilatation. This supposition was strengthened by the excessive thirst, absence of peritonitis, and intestinal obstruction, and further by the fact that



despite the regular evacuations by the tube the stomach not only had remained distended but during the last 24 hours evidently had increased in size.

As a guide to treatment, my first thought had been the discussion in our surgical society, which I read over, but the modes of treatment mentioned there were evidently not fully efficient. The objection might be made that my patient was continually allowed to drink, but her thirst was so extreme that it seemed altogether inhuman to prevent her from so doing. Under these circumstances I was obliged to seek other sources of information in the literature at hand. I sought for some time in vain, but ultimately in Moynihan<sup>1</sup> I found the following: "In my own few cases, relief has always been given by changing the position of the patient. He must be placed prone in bed." I was soon to have use for my newly acquired knowledge.

March 4 — T 36 3, 36, P 116 The patient's appearance has since yesterday evening undergone a striking change. Her face is hollow, and its expression inert. Death seems near. Her pulse, which the whole time has been unalterably full, is now nearly thready, and the patient herself whispers that she has not many moments left.

During the last 24 hours she has drunk 500 cm water and gruel and received 6 rectal enemata, but her thirst is the same. The distention of the stomach has further increased. With a stomach tube we emptied 1½ litres of fluid of the same appearance as before, but with a more unpleasant odor. The tubing brought little or no relief.

*At 12 o'clock midday we laid the patient on her chest, with a pillow under the pelvis and one under her shoulders and throat, which induced the exclamation, "Oh, that was nice!"*

From the moment she came in that position, her condition has changed. Vomiting has ceased altogether, and all feeling of fullness and pain in her abdomen is swept away. She declares she has become another person, and the change in her appearance in the course of half an hour is a perceptible corroboration of the fact.

March 5 — T 36 3, 36 8, P 116 The patient has lain prone in bed nearly the whole of the time since yesterday midday. Now and then, for a moment's change, she has lain on the right side, but prefers to lie on the abdomen. She says she feels well, her appearance is good, and her face has resumed its former plumpness. Since yesterday midday she has taken 600 ccm water gruel, 1½ litres milk, four eggs, and a little water now and then, all without the slightest inconvenience. Although she has

besides received four saline enemata, she is still thirsty. "It is nice to get plenty to eat and drink now," were her first words this morning.

At the evening visit, for safety's sake, we introduced the stomach tube. This brought up only 50 ccm from the stomach. The fluid was gray brown (water gruel) and without odor. It had thus, since the morning, changed both in substance and color. In the night the patient twice passed urine spontaneously. Proctoclysis was discontinued and fluid food allowed without restriction.

March 7 — T 36 9, 36 9, P 96 Patient still lies prone in bed and has slept comfortably in that position. She looks and feels well, but is still thirsty. She is now placed on her back.

March 8 — T 36 5, 36 5, P 100 Has in the last 24 hours lain mostly on her back, and drunk more than the day before. Feels extremely well, and is allowed solid food.

Her further progress presented no complications. According to report of May 15, 1912, the patient has been and is quite well.

CASE 2 Gunda P., married, aged 27, entered Diakonhjemmet August 7, 1910, discharged August 30. Patient's family history good, always been well herself. Menstruation in order from 15th year till a fortnight ago, when it failed to appear. Patient has had no children or abortions and has never been troubled with indigestion.

While dressing this morning the patient was suddenly attacked by violent pains in the lower regions of the abdomen. After a while she felt better but with new movement came an even more severe attack, so that she nearly fainted. She could hardly reach the sofa where her husband found her, white as death and half unconscious. A doctor was called in and sent her to our hospital.

Status — The patient is in extreme anemia, all mucous membranes bloodless. P 96, T 36 3. Lungs and heart are in normal condition. Abdomen slightly distended and extremely tender over the pubes, where there is a dull zone of 8 to 10 cm. Urine normal.

Exploration reveals a soft tumor behind the uterus most prominent in the middle line. The uterus is displaced upward and forward, lying close behind the pubic arch. After exploration a new attack of pain ensued, wherefore we at once prepared to operate.

Operation Salpingotomy dextra was performed at 12 o'clock noon. Upon opening the abdomen a quantity of blood, partly fluid and partly clotted, was seen to occupy the lower part. The source of the hemorrhage was the right tube, which formed a walnut-sized tumor, the top wall of which had burst in its whole length. The tube was ligated and excised, the blood scooped out, and the abdominal cavity cleaned as well as possible.

Twenty minutes before the narcosis, 1 cgr morphia was given subcutaneously. The anæsthetization — on open gauze mask — commenced at 12.10.

<sup>1</sup> Abdominal Operations<sup>2</sup> 2nd ed p 85

Unconsciousness supervened 10 minutes later, after 55 ccm. of ether. The whole amount of ether used was 170 ccm. The narcosis was easy and without complications of any kind.

Aug 8 — T. 36.1, 37.3, P. 80 Tongue clean, humid Yesterday afternoon, in connection with the operation, patient vomited four times. After 1 cgr. morphia subcutaneously she slept fairly well. No sickness in the night. To-day white as death, languid, with widely dilated pupils. Abdomen hollow, soft, and not tender. Patient is very thirsty. She has been given milk and water by teaspoonfuls, but she has, it is stated, on account of the fearful thirst, drunk much more than permitted.

Aug 9 — T. 38.3, 37.2; P. 108. Later in the morning the patient began to vomit and complains of violent pain in the epigastrium. In the course of the day she has vomited 8 times — a thin gray-brown fluid with no odor. At the evening visit she still complains of severe pain. She has been given 1 cgr. morphia and ingesta of any kind is forbidden. Vomiting has continued part of the night, however, sometimes without anything coming up. To-day there is some distention and tenderness in the epigastrium and the whole of the parts above the navel, while the abdomen below the navel is neither tender nor distended. With the stomach tube  $\frac{1}{2}$  litre gray-green fluid was evacuated. The patient is still forbidden to eat or drink.

At 8 P. M., flatus has been passed since the middle of the day, 48 hours after the operation. Although the patient has not drunk anything, vomiting increases, the vomit to-day being greener and containing bile. Pain unchanged, also thirst. The abdomen is more distended in its upper and left part, and by percussion splashing sounds are heard. The patient feels very ill, and declines absolutely to have a stomach tube introduced. *She is laid prone in bed, with a pillow under the chest and throat and one across the groin.*

Aug 10 — T. 38.2, 37.1, P. 100. The patient slept well during the night. She lay yesterday evening first for  $\frac{1}{4}$  hour on the abdomen, then the same length of time half on the abdomen and half on the right side. She slept lying on her left side, and slept the whole night, from the same moment she lay prone in bed, her pains and desire to vomit ceased.

When she woke this morning, she lay of her own accord on the abdomen, and drank an aleglassful of barley gruel and half a glass of milk without any unpleasantness before the morning visit. Her appearance is totally changed. She is smiling and pleased.

Aug. 11 — T. 38, 37.4, P. 84. The patient is pale, but her appearance further improved. Yesterday morning she drank plenty of milk without inconvenience. She lay yesterday nearly the whole time on the abdomen, much more than was required of her, as she was quite convinced that it was that, which had relieved her of the pain and vomiting. For dinner she ate some fish and milk soup, for sup-

per, porridge and milk, all with satisfaction. In the middle of the night she woke and turned over on her back, and slept thus until the morning. She ate breakfast to-day with a good appetite. The abdomen is now more distended than before, but the distention is even. There is no tenderness.

Aug 12 — T. 37, 37.3, P. 80. Perfectly well. Eats and drinks as if nothing had occurred.

The patient was discharged August 30, in excellent condition, and informs me, May 10, 1912, that she has been quite well ever since.

CASE 3. P. A., aged 43, male, was admitted to Diakonhjemmet August 26, died September 29.

His illness began three years ago with an attack of three weeks' duration. He had abdominal pain several times a day, with eructation of acid fluid followed by one or more vomitings. He also vomited regularly directly after meals. When the attack was over he felt comparatively well, only feeling slight pain now and then, sometimes accompanied by eructations, but he was always able to do his work. He was taken ill again a fortnight ago with epigastric pain radiating backward. The pain began suddenly from  $\frac{1}{4}$  to 1 hour after meals and lasted for about an hour, not appearing unless food was taken. During this last attack the patient had no eructation or vomiting. In the course of the last month he has noticed a rapidly increasing swelling of the scrotum.

On admission he complained of such violent pain in the left hypochondriac region and back that he could not lie down. The abdomen was moderately distended, there was exquisite tenderness below the left costal margin, and on the right side some rigidity. The right margin of a flat, immovable tumor is felt on the posterior abdominal wall a little above the navel. On physical examination, heart and lungs were found normal. Urine sp. gr. 1015, no albumen, no sugar. The left testicle forms a firm, even, and not tender tumor, the size of a closed hand.

Operation. Sept. 4. Pericolic adhesions of the common type were found on the ascending colon and the hepatic flexure. The upper part of the ascending colon was compressed and its lower part, with the cæcum, decidedly distended. The adhesions were separated till the bowel was freed. Stomach, duodenum, and gall-bladder showed no irregularity. Behind the pancreas a firm retro-peritoneal tumor, thicker and broader than a hand, adheres to the spine, and extends on the left side upward to the diaphragm.

Ether narcosis: 25 minutes before the anæstheticization, 15 cgr. morphia was given subcutaneously. Narcosis supervened after 15 minutes, requiring 55 ccm. ether, it lasted for 57 minutes, the operation, 40. Total consumption of ether, 165 ccm. The narcosis was easy and without complications.

Sept. 5 — T. 36.7, 36.6; P. 80. The patient has borne the operation well. General condition very good. No vomiting since the operation, and 13

hours later flatus was passed. Fluid was allowed ad libitum.

Sept. 6.—T. 36.7, 36, P. 108. No vomiting until last night at 9. The patient has since vomited four times, and altogether 2 litres of thin, greenish and odorless fluid. He complains of fullness in the epigastrium, moderate pain, and severe thirst. His aspect is unaltered. By stomach tube 800 ccm. greenish brown fluid were evacuated. Food and drink forbidden. Proctoclysis.

Sept. 7.—T. 36.8, 36.5, P. 124, and scarcely perceptible. After the gastric lavage yesterday morning the patient felt relieved and the vomiting ceased for 8 hours; it then reappeared and gradually increased in frequency. During the last few hours there has been an interval of only 5 to 10 minutes between the vomitings, but during the night not more than about 500 ccm. have been vomited. The patient complains of abdominal distention and moderate pain; thirst worse than ever. His aspect and general condition have undergone a striking change since yesterday. His face is livid and pinched, his eyes hollow, and nose and extremities cold. The upper part of the abdomen is moderately distended, and by percussion and shaking splashing sounds are elicited, and show that the greater curvature in the left side lies three fingers' breadth below the umbilicus.

By the stomach tube, directly after a vomiting, 900 ccm. thin, black fluid were evacuated, which contains blood but gives an indistinct bile reaction. As the diagnosis, acute gastric dilatation, seemed certain, the patient at 9 A. M. was placed prone in bed. It was difficult to find a position that did not cause pain in the abdominal wound, but at last we succeeded. Absolute diet and proctoclysis were continued.

Sept. 8.—T. 36.3, 36.6, P. 100, fairly good. Since yesterday morning the patient has been prone, for a change he has lain on the right side only for 15 minutes every other hour. Since he was turned over on the abdomen he has felt quite well, all nausea and vomiting have disappeared, and his aspect is completely changed. His face has regained its natural expression and fullness.

Last night and this morning a stomach tube was introduced, and by aspiration 20 ccm. black, to-day 130 ccm. greenish, fluid were evacuated. Abdominal posture and proctoclysis were continued.

Sept. 9.—T. 36.6, 36.2, P. 96. Last night, through the stomach tube, 20 ccm. light green, and this morning 15 ccm. greenish, fluid were aspirated. General condition good, although the patient has slept little on account of the discomfort from the abdominal wound caused by the prone posture. The stomach is not distended, and no splashing sound has been elicited since the postural treatment began. Fluids allowed in restricted quantity.

Sept. 10.—T. 36.8, 36.1, P. 96. The patient last night lay semi prone on the right side and slept fairly well. He enjoys his fluid nourishment. On the whole, no sickness or vomiting have occurred

during the last three days. Solid food and ordinary posture are allowed.

Sept. 22.—Uninterrupted satisfactory reconvalescence without gastric symptoms till last night. The patient then, after a chill, had pain in the right side of the chest and began to cough. The formerly normal temperature rose to 38.5. To-day, examination reveals a pneumonia of the inferior lobe of the right lung.

Sept. 29.—The patient gradually lost strength, and died on the seventh day of the pneumonia.

*Post-mortem* The stomach was found normal, with the exception of two small ulcers at the lesser curvature. The tumor of the testicle proved to be a sarcoma, and the retroperitoneal tumor in the upper part of the abdominal cavity a metastasis to the prevertebral connective tissue.

The two following cases, which are of much interest and have not been published before, were kindly submitted by Dr. P. Bull.

CASE 4. N. H., boy 9 years old. From his earliest years he has had "a sensitive stomach." He felt oppressed sometimes, and had pains under his chest after meals. January 31, 1912, he had a severe attack of appendicitis. On February 4, appendectomy was performed in his home under ether-chloroform narcosis, and a pelvic abscess incised and drained.

Feb. 5.—Since the operation the patient has been restless and has frequently vomited a black fluid. T. 38.6, P. 140.

Feb. 9.—T. 36.8, P. 88. Patient has become better little by little, and his condition has been fairly satisfactory during the last few days. To-day fecal matter is seen to escape through the wound.

Feb. 15.—The patient has been moved from his home in the country to "Red Cross Clinic," Christiania. His appearance and appetite are improved. The wound is wholly open, in its upper median part the lesser bowel is slightly protruding, and on its surface two small perforations are visible, which discharge thin yellow faeces, while only now and then slight flatus has been passed through the anus.

Feb. 17.—After an enema yesterday a moderate quantity of fecal material was evacuated. To day, spontaneous movement of the bowels. Appetite satisfactory.

Feb. 23.—During the last two days all discharge from the intestinal fistula has ceased. In the night at 2.30, the boy had a severe attack of pain in the middle of the abdomen and has since lain in unceasing misery. This morning he vomited four times and twice had normal relief of the bowels. The abdomen is not distended but is somewhat tender. No fever, pulse 84, good.

Feb. 24.—No fever, P. 80. Since yesterday one thin greenish vomiting. Flatus passed. Patient complains of pain in left side of abdomen, where he is tender. The rectal wall is somewhat prominent and tender to the left. Under chloroform, a para-

rectal abscess is incised and a tablespoonful of thin pus is emptied from a cavity the size of a walnut, which is then drained.

This evening, since awakening from the narcosis, the patient still lies and screams with pains in the abdomen. Has twice vomited a small quantity of thin greenish fluid. Pulse 90. No flatus and no discharge from the fistula. The abdomen is tender, still only slightly distended, and with no noticeable change in its shape. No dullness and no splashing sounds. The patient is much too restless for any thought of stomach tube.

Dr. Bull concluded that there existed a high intestinal obstruction, and at 7:30 in the evening a laparotomy was performed under chloroform, 12 cm median incision with the navel as a center.

No fluid in the abdominal cavity. The small intestine was found in two places to be adherent to the short omentum and to the abdominal wall, from which it was easily separated. Directly above both adhesions the intestine is a little, but very little, distended; but the greater part of the intestinal portion lying between both adhesions is collapsed. The same is the case with the whole of the small intestine below the lower, and the greater part of the small intestine above the topmost adhesion, right up to the duodeno-jejunal plicca. Near this is found a transversal, strongly distended, gray-red intestine, which proves to be the horizontal part of the duodenum. Its dilatation ends suddenly at the point where the mesenteric artery, tightly strained, runs in front of the duodenum.

The reason for the compression of the duodenum by the mesenteric vessels cannot be decided. There are no loops of the small intestine in the pelvis, this is shut off from the abdominal cavity by the adherent *S. romanum* and its mesosigmoidum. The adherent lesser bowel does not seem to have exercised any traction on the mesenterium, nor does the perforated loop, which belongs to the lower part of the ileum, exert tension in any direction. The distention of the duodenum is unmistakable at any rate, and the only thing of consequence discovered by the operation.

The stomach is globular in shape and somewhat distended, but the greater curvature lies 3 to 4 fingers' breadth above the navel.

The wound was closed without anything being done to the duodenum or the strained transverse mesocolon. The operation lasted about an hour. Directly afterwards, a subcutaneous saline infusion of 1 litre was given.

Feb. 25.—No fever, P 90. The patient has been restless during the night, and screamed as before. He has vomited four times. In consequence of the discovery made at operation, *the patient is laid prone in his bed*. The very moment he was placed thus he said, "That is nice." He is allowed to drink water.

Feb. 26.—T. 37.4, 36 5; P. 120, 90. The patient slept on his abdomen 4 hours during the night, and was quiet. Vomiting and the earlier screams and

intractability have all ceased since he was placed on his chest. Likewise, the discharge through the intestinal fistula, which since February 21 had entirely ceased, has now recommenced. General condition better. Continues to lie on the abdomen and feels well thus.

Feb. 27.—Without fever; P. 90, 84. The patient is quiet, has not vomited, and slept nearly the whole of the night in the abdominal position. He has now lain 48 hours on his abdomen, only now and then being moved half on his right side half on his left, a short while at a time, for a change. He is now moved onto his back and given liquid food. Later, continued improvement without complications.

The intestinal fistula on the ileum was closed under chloroform by enterorrhaphy on March 28, and the patient left for home in good condition on May 1.

CASE 5 R K., aged 65, a doctor in Christiania; treated at home. He had for 25 years suffered from indigestion now and then, but never had been ill enough to have to neglect his practice. During his holiday trip in August, 1912, he had diarrhoea and felt tired for a fortnight, but had improved considerably, when on August 25 he was taken ill with nausea and epigastric pain.

Aug. 30.—During the last five days the patient has had attacks of pain below the right costal margin, where a formerly more diffuse tenderness has become localized and increased in intensity; in the same place he feels an inspiratory "catch," and sometimes the pain radiates to the chest. He feels sick, especially with movements of any kind, but does not vomit. There is a constant muscular rigidity on the right side of the slightly distended abdomen. The temperature has risen a little, and once has reached 38. Urine concentrated, without albumin or bile. The condition is regarded as subacute cholecystitis.

Sept. 4.—The pain, fever and rigidity have disappeared, but there is still some tenderness below the right costal border. Flatus has been passed the whole time. Yesterday and to-day, without inconvenience, the patient has had tea, toast and milk gruel, after having been without food or drink for three days.

Sept. 5, 6 P. M.—The patient awoke at 4:30 this morning, feeling extremely giddy. Shutting his eyes, he felt better; but looking up, everything in the room seemed in a whirl. He began to vomit a thin bile-stained fluid. The vomiting came on again every time he took any fluid, with little evacuation at a time, but in the course of the day about 1 litre. No flatus since yesterday. When Dr. Bull saw the patient in the afternoon, he found him greatly altered since the previous day. His look was apathic, his face pinched, his extremities cold and clammy, the formerly normal pulse was thready, with a frequency of 92. The abdomen was, in the left hypochondrium only, a little distended, but nowhere tender or rigid. By percussion the gastric

sound was found to extend from the left fourth rib in the mammillary line to the umbilicus. There was no fever. As the condition was diagnosed as acute gastric dilatation, the patient was given choice between stomach tube and abdominal posture, and preferred the latter. At 6.30 P. M. he was placed prone in bed supported by a number of pillows. Food and drink were forbidden.

An hour later Dr. Bull saw the patient again, and found his hands warm, the face normal, the pulse 100 and full, the nausea had ceased and the general condition was satisfactory.

Sept. 6 — The patient remained prone till 1 A. M., he was then turned on the right side. Since the abdominal posture was adopted, he has not vomited, nor has he felt sick or giddy. From 11 last night flatus has been passed.

Sept. 7 — Still no vomiting. Since yesterday the patient has taken 200 ccm. milk and water and a little bread.

Sept. 21 — Uninterrupted recovery. The patient has neither felt giddy nor sick since the 5th. There has been no abdominal pain or tenderness nor any gastric symptoms. The daily ration has successively been increased and has now reached 1500 calories.

Dr. Bull adds the following epirrhesis: "The patient had on the 25th of August probably acquired acute gastritis, perhaps caused by intestinal infection. In addition to this a slight peritonitis localized to the epigastrium and right hypochondrium developed, which, from its course, probably was owing to an acute cholecystitis. When the illness had abated and the patient began to take some nourishment, symptoms of acute gastric dilatation suddenly developed. As a peculiar and to the patient, distressing inaugural symptom of the dilatation the intense giddiness has to be noted, 12 hours later characteristic signs of collapse were present. The effect of the postural treatment was particularly noticeable within an hour, not only to the doctors who were present but also to the patient himself and to his relatives."

The following two cases from the Rigshospital were not treated with abdominal posture.

CASE 6. A. I., male, 20 years old, sent to the Rigshospital Surgical Division B, May 20, 1907, for tuberculosis of the kidneys.

The patient has always been hoarse and prone to colds and cough, but otherwise well and especially free from gastric troubles. His present illness commenced a year ago with painful and continual passing of urine. This condition has become worse by degrees, though the patient's general condition and appearance have suffered but slightly.

Operation: June 5, nephrectomy dextra was performed under chloroform.

June 6 — T 37.2, 36.3, P 100-96. Since the operation, vomited four times, quantity of urine 0.50 ccm. Milk and barley water given in teaspoonfuls.

June 7 — T 36.8, 37.1, P 130. Very restless during the night on account of pain over the whole

of the abdomen, which was somewhat distended and tender yesterday evening. He was given a rectal enema of 34 litre yesterday evening, after which the bowels moved freely. He vomited a thin yellow-green fluid several times yesterday, also during the night at short intervals.

This morning with the stomach tube we emptied 1 litre greenish fluid, which eased the patient. In the course of the day he was given 3 camphor injections and 1 of digalen. Amount of urine 750 ccm.

June 8 — T yesterday evening 37.8, pulse thready, uncountable. The patient is quite conscious but somewhat restless, and complains of fullness and pain in the abdomen. Vomited twice yesterday. The whole abdomen, but especially the epigastrium, is distended and tender. Yesterday midday he had a subcutaneous saline injection of 1 litre, without noticeable effect. During the night much restlessness and vomiting. Senses clear. Every 3½ hour 1 ccm. oleum camphoratum was given subcutaneously and yesterday evening a digalen injection. Patient died at 4 o'clock this morning.

At post mortem tuberculosis of the bladder and left kidney was found, also considerable dilatation of the stomach and duodenum.

CASE 7. Th. M., male, aged 27, sent to the Rigshospital Surgical Division B, October 16, 1910, for osteomyelitis tibiae.

The patient has, during the last three or four years, felt pains in his right leg when he exerted it; otherwise he has been well. Last week he had violent pains and tenderness under the right knee, and one or two chills. His temperature throughout has been between 38 and 39°.

Operation: October 16, osteotomy tibiae was performed under scopolamin-ether narcosis. A small abscess, which extended into the medullary canal, was opened and thoroughly exposed with a chisel.

Oct. 21. Fever of a septic type, due to a suppuration of the knee joint. This was incised on both sides and a considerable quantity of pus evacuated.

Oct. 24. Condition much better, senses clear, but continued high fever.

Nov. 1. The skin over the tendo Achillis is necrosed. The fever has by degrees somewhat diminished.

Nov. 14 — T 37.6, 36.3. Since last night the patient has vomited as soon as he has partaken of food. To day the left side of the abdomen is tender, and distended from the epigastrium to the pubes. The right side of the abdomen is not distended, but on the contrary is rather hollow.

Nov. 15 — Distention of the abdomen has increased and now reminds one of a strongly dilated stomach. There is much tenderness, muscular rigidity, and dull percussion sound in the distended part which seems fluctuating. The tenderness, however, is so excessive that no examination is possible. The patient died at 4 o'clock this afternoon.

*Autopsy.* General sepsis, pericarditis, miliary abscesses in the kidneys, parenchymatous degeneration of the spleen and liver, dilatation of the stomach and duodenum.

The greatly dilated stomach reaches midway between the umbilicus and the symphysis, the duodenum, the common, cystic and hepatic ducts are also considerably distended.

The following synopsis is based upon 144 cases of acute dilatation of the stomach — the 7 referred to above and 137 from the literature. With the exception of Jessop's and Hohenegg's two cases, which are included to complete the list of dilatations of the stomach treated by operation, all the others, which are culled from literature, date from later than 1895, the year in which Schnitzler suggested laying the patient prone in bed as a treatment for the illness. Thus, my work is partly a continuation of the latest published literary works of the American authors Conner and Laffer.<sup>1</sup>

Of 130 cases where sex is mentioned, 78, or 60 per cent, were women and 52, or 40 per cent, men. The 118 cases where age is mentioned belong to the following decades:

1st decennium	1 case, or 0.8 per cent
2nd decennium	21 cases, or 17.8 per cent
3rd decennium	32 cases, or 27.1 per cent
4th decennium	30 cases, or 25.4 per cent
5th decennium	20 cases, or 16.9 per cent
6th decennium	10 cases, or 8.4 per cent
7th decennium	4 cases, or 3.4 per cent

This goes to prove the same proportion which Conner has found, that three fourths of the patients acquired their illness between the tenth and fortieth years. Payer has the youngest patient, a boy 4 years old, and P. Muller the eldest, a woman of 65.

If one takes into consideration the condition of the patients when the dilatation of the stomach began, which must be supposed to have more or less affected the development of the dilatation, we can divide the cases into several groups, some of which are well defined.

1. *The post-operative cases* contribute the largest number, with 92 cases out of 138 in which the condition when the dilatation occurred is mentioned, or 66.6 per cent.

<sup>1</sup>The collection from the European, especially the German and Scandinavian literature is at any rate nearly complete as to the best of my knowledge all certain cases of acute dilatation of the stomach mentioned between 1895 and 1910 are included. From the English and French, but especially from the American provincial literature many are wanting. My collected references show which authors' cases are used.

Laffer's review of the literature from 1908, without doubt the most complete printed, but which includes all earlier known cases, has by comparison only 38.2 per cent post-operative cases.

Of 92 operations, 71 are laparotomies and 21 extra-abdominal operations. Among the laparotomies, operations on the female genital organs give the largest and operations on the gall system the next largest contingent, with 30 and 17 cases respectively; after these come 8 appendix and 3 hernia operations, together with 7 intra-abdominal operations of different kinds, and finally a most remarkable secondary group, consisting of 6 operations on the stomach itself, 1 pyloric resection, 4 gastrojejunostomies, and 1 gastroduodenostomy (Tschudy, Zade, Haberer, Payer, Schilling, and Finney). Of the 20 extra-abdominal operations, 5 were performed on the kidney, 8 on the extremities, and 1 on the face; the rest were on the thorax.

All the operations, with one exception, were performed under general narcosis. The narcosis administered was in 12 cases chloroform, in 8 ether, in 5 chloroform ether, in 1 chloroform-ether-oxygen, in 2 chloroform-morphia, in 4 ether-scopolamin-morphia, in 1 ether-scopolamin-morphia after veronal, in 3 ether-morphia, and in 1 ether-morphia-atropin. The statement made by von Herff and others, that chloroform is specially responsible for post-operative dilatation of the stomach, seems thus not consistent.

In 66 post-operative cases one could approximately decide the time for the appearance of the dilatation of the stomach. In 23 cases the illness commenced within the first two days. One will, however, be in doubt as to the time for the greater number of those cases belonging to the first 24 hours, as the symptoms of the dilatation under these circumstances are not easy to distinguish from narcosis vomiting. The illness commenced three days after the operation in 19 cases, about four days after in 5 cases, and five days later in 4 cases; 1 case dates from the sixth day and 2 cases from the seventh. It is thus shown that the majority of post-operative dilatations of the stomach commence about the third day, much oftener before than later.

It has even been observed that distention of the stomach can occur during the operation. Moorhead seems to have met the dilatation, so to say, *in statu nascenti*; during a laparotomy after a completed perineorrhaphy he noticed a tumor suddenly forming in the abdominal cavity; the tumor was incised and proved to be the stomach, which was then emptied by a tube.

On the other hand, some stray instances are found where the dilatation occurred much later than mentioned above. Thus, Chavannaz saw it commence the ninth, Mayo Robson the tenth and fourteenth, and Nakahara the sixteenth day. In our Case 7 the illness commenced on the twenty-fourth and in Jessop's case the thirtieth day after the operation. These gastric dilatations which appear so late, after the effect of the narcosis and the operative insult must be considered as having passed, cannot correctly be termed post-operative. Then such cases may either be referred to an incidental cause during convalescence or to a severe illness following upon the operation. In Nakahara's case tetanus supervened; in our Case 7, general sepsis. Such cases ought perhaps to have been noted under the next group.

2. *Dilatation of the stomach which has arisen during the course of an acute illness or its convalescence.* Fifteen cases belong to this group; 7 caused by pneumonia, 4 by typhoid fever, and 1 each by scarlatina, acute rheumatism, endocarditis, and cholecystitis.

Dilatation occurred during pneumonia in Hanssen's, Lehmann's and Box and Wallace's cases on the fifth day of their illness, in Herrick's case on the ninth, and in Leonhardt's 2 cases the eighth and sixteenth days, respectively.

Among the cases of typhoid fever, Wichern's 2 patients developed dilatation of the stomach after 21 and 26 days, Baumlér's in the fifth week, and Heine-Ewald's "during convalescence." Likewise Albu's and Bloodgood's patients were convalescents after scarlatina and acute rheumatism, and my patient No. 5 after cholecystitis. At what stage of his endocarditis Mayo Robson's patient developed dilatation is not mentioned.

It is stated that Bloodgood's and Baumlér's patients had good appetite during the last few days; Wichern's patient No. 2 had kyphoscoliosis. As regards the others in this group, no mention is made of any fact which can have contributed to the development of the dilatation. In my Case 5, the dilatation began after the first food taken after 3 days of fasting.

3. *Dilatation during chronic illness.* Of such cases we find two during consumption of the lungs (Conner, Hanssen), 1 during diabetes (Hanssen), 1 during sciatica (Baumlér). The patients here referred to are as a rule emaciated and exhausted, in a debility which nearly equals a post-operative state; but the group also includes cases in good condition. In Conner's case one comes to the conclusion that an irregularity of diet or overfilling of the stomach was probably the incidental cause. It is mentioned that the patient had eaten better a day or two preceding the dilatation. In one of Hanssen's cases (No. 9) the dilatation, which was not observed during life, seems to have arisen just before death, while his other patient belonging to this group (No. 8) was in comparatively good condition. In none of the cases do we find any mention of an incidental cause, in Baumlér's case (No. 2) it is positively stated that irregularity of diet or other incidental cause was not traceable.

4. *Dilatation of the stomach by disorder or deformity of the spine.* Under this heading we find Kelling's case of highly developed lumbodorsal scoliosis and 6 cases of spondylitic kyphosis with or without scoliosis (Kirch's, Neck's cases 2 and 3, Kausch's two cases, and Hanssen's Case 7). Wichern's second patient suffering from typhoid fever also had a right kyphoscoliosis. In Kausch's Case 2 and Hanssen's Case 9 the tuberculosis of the spine had entailed a more or less pronounced paraplegia, and they can therefore be compared with Bloodgood's Case 4 of paraplegia caused by syphilitic myelitis.

This group comprises highly dissimilar and for the most part complicated cases. The three paraplegic patients are all much reduced by their chronic illness, and if this had not been allied to a nerve trouble, their

right place would have been in Group III. In Hanssen's case, without doubt, the primary cause of the dilatation's commencement lies in the presence of the enormous dorsolumbar scoliosis, which hardly left space for a finger between the xyphoid process and the spine; over this the duodenum rides, and thus opportunity for a kink or compression of the intestine is given. In the other cases it is scarcely reasonable to think that the scoliosis (sometimes right and sometimes left) or an inveterate kyphosis has been the only reason for the dilatation. On the contrary, one may be inclined to doubt whether the spinal disorder has had any influence on the onset of the dilatation at all. For with Kelling's, Kirch's and Neck's (No. 3) patients, all of whom were somewhat delicate but were in ordinary health at the time of the illness' commencement, the dilatation arose in direct connection with a palpable overloading of the stomach. Kelling's patient, who usually ate enormously, had eaten Schoppsenfleisch with beans and two unpeeled pears the third day after fitting a new corset, Kirch's had had three platefuls of bread soup and a glass of Weiss beer; and Neck's patient No. 3, three bowlfuls of buttermilk, when the illness broke out. Of Neck's 40-year-old patient, who had always been well and without digestive or intestinal troubles of any kind, the only factor predisposing for dilatation of the stomach which is mentioned was a stationary dorsal kyphoscoliosis of long standing.

5. A remarkable group is composed of cases in which the dilatation is attributed to *overloading of the stomach*. Under this heading I have included only patients with whom no other explanation is found for their illness, or where other conditions, such as a slight weakness or earlier dyspepsia, are quite insignificant beside the single overloading. Of this sort the collection contains 10 cases: Bastedo's (Nos. 2 and 3), Hanssen-Löberg's, Heine's, Hoffmann's, Houston's, Korte's, Landahl's, Sommarin's, and Wahlstrom's. But it is doubtful whether several cases from the previously mentioned groups do not by right belong here. As an instance, Kelling's patient is placed by Conner in this category,

and Kirch's and Neck's (No. 3) cases probably ought also to have been included.

Some of these patients have been somewhat weakly and others formerly had dyspeptic symptoms now and then, but on the whole the group seems to comprise healthy people in the ordinary sense of the word. Of their earlier health nothing is said in Houston's, Korte's and Bastedo's (No. 2) cases; of Heine's, Landahl's and Bastedo's (No. 3) patients it is remarked that they were in a good state of health, but had now and then had dyspeptic symptoms; Wahlstrom's patient was delicate, but Hanssen-Löberg's, Sommarin's and Hoffmann's were quite well—the last two accustomed to overfeeding; it is remarked of Hoffmann's patient that he usually had a large appetite and often ate three or four times more than others and without masticating his food: "er schlang vielmehr das Essen hinunter."

Hoffmann's, Landahl's and Hanssen-Löberg's patients came home tired after enervating work; the last named, as well as Korte's patient, ate in haste, and with Bastedo's patient (No. 3), the stomach became suddenly distended by a "very big dose" of tartaric acid and sodium. In the other cases, special circumstances with the overloading were not given, and its nature and degree are in the different cases very varied. In Hanssen-Löberg's, Korte's and Bastedo's (No. 2) cases the dilatation made its appearance immediately after a hearty meal, consisting of six meat cakes and a plateful of soup in the former, of "Mohr-rueben" in the second, and in the last-named of ham and cabbage; in Houston's, Landahl's and Sommarin's cases the overloading was caused by raw fruit; Heine's patient had, besides whisky, drunk three or four bottles of champagne. With Hoffmann's gluttonous patient the critical meal was not particularly big, and in Wahlstrom's case it is only stated that the illness made its appearance "after breakfast."

In 8 of these cases the time between the meal, i. e. the inflating of the abdomen in Bastedo's Case 2, and the commencement of the illness is noted. In both Bastedo's and Hoffmann's cases the disease began at



once; in Heine's and Landahl's it began after 6 to 8 hours; in all these cases in full violence from the beginning. In Wahlstrom's and Sommarin's cases the malady seems to have begun, but not severely, after the lapse of a few hours and 12 to 16 hours respectively. The illness reached its full intensity two days later in both cases. We have specially accurate particulars of Hanssen-Loberg's patient. He became violently ill an hour after a meal, and was operated 3 or 4 hours later,<sup>1</sup> the stomach was then distended nearly to the pukes.

Six of these 10 patients died. With 3 of them the diagnosis was verified both by operation and post-mortem (Hanssen-Loberg's, Hoffmann's and Korte's), with Sommarin's by operation and Wahlstrom's post-mortem. It is thus proved that even in the case of a person in good health a severe dilatation can develop after a single more or less considerable overloading of the stomach. Overexertion and earlier digestive troubles seem to be predisposing factors. The quickness with which the stomach has been overfilled plays probably also an important part. We find several typical instances of the same kind from olden days, among these Winge's case (Hanssen's Case 1).

As an appendix to this group, we can include Kayser's Case 1. In this instance it is the quality of the food and not the quantity which is the cause of the dilatation: it appears to have been a meat poisoning.

6. A blow on the abdomen is named as the cause in Appel's and Box and Wallace's cases. Both patients were sent to the hospital with the diagnosis of ileus. The time elapsing between the injury and the commencement of the illness is not mentioned. In both cases dilatation of the stomach was proved both by laparotomy and post-mortem.

7. Confinement is likewise followed by dilatation of the stomach in two cases (Campbell, Thomson and Lasser). The dilatation was noticed in the first hours after birth in both cases, and both ended fatally.

8. Finally we have a last group, *without any explanation for the dilatation*. In two cases (those of W. H. Brown and Wright) the illness

commenced with the appearance of ileus in two quite healthy subjects, and without known cause. Schmorl's patient also belongs most reasonably to this category, he having been taken ill, as recorded, after violent laughter.

It must also be mentioned that there sometimes seems to be present an *individual disposition* to acute dilatation of the stomach. Legueu first drew attention to this fact. He noticed such a condition after performing two operations with a long interval on the same man. Later Chavannaz, Payer, and Bloodgood (Case 6) made the same observation. The latter's patient was operated twice with a 6 months interval, and both times for an inguinal hernia. The first operation was performed under ether, the last under local anæsthesia, as far as I know the only case in which dilatation of the stomach has occurred after the use of a local anæsthetic. Such a disposition seems, however, not to exist in every case. My patient No 2 was readmitted to Diakonhjemmet with rupture of a tubal pregnancy, and was operated two years after the above described operation. The circumstances were similar to those two years ago, excepting that a strict control was kept over the fluid which the patient drank. This time no symptoms of gastric dilatation were noticed.

#### SYMPTOMS

The chief symptoms are *vomiting, abdominal distention and collapse*. Symptoms of secondary rank are pain and tenderness over the distended stomach, insufferable thirst, and scanty urine. The function of the intestine is different in different cases, it may have ceased or be more or less uninfluenced.

The better the patient feels beforehand, the more sharply defined the symptoms of the dilatation of the stomach appear. One therefore sees the illness in its purest form after less serious operations; it becomes most conspicuous, however, after the overloading of the stomach in healthy persons. In a case of medium severity, the dilatation will as a rule first show itself by the patient complaining of pain and distention of the epigastrium together with increasing thirst. He will then begin to vomit without subsequent relief.

<sup>1</sup>The operator's statement

The vomiting occurs at short intervals, and once commenced, it becomes one of the illness's most prominent features, which Legueu has appropriately compared with the continual emptying of the urinary bladder under an *ischuria paradoxa*. A distention of the stomach develops rapidly. From the commencement it includes the epigastrium; by degrees it extends downward past the navel, and can perhaps reach to the lower parts of the abdomen. The stomach which was normal at an operation yesterday may to-day have become cyanotic and hyperæmic and occupy the greater part of the abdominal cavity. For, as Riedel says, it is a decided fact that a formerly sound stomach can expand quite down to the pubes in the course of 24 to 48 hours.<sup>1</sup> This can even, as Hanssen-Loberg's case shows, happen after the lapse of a few hours. As a rule the distention is largest in the left side of the abdomen, while the right takes little if any part. This is accounted for by the form an extremely distended stomach assumes. Like a thick tube, its *fundus* part runs in a curve down toward the left Poupart's ligament; here it bends at an acute angle and a similar pyloric tube runs nearly along the longitudinal axis of the body upward to the right border of the gastrohepatic omentum.

The general condition of the patient is from the beginning less affected than one would imagine by the constant vomiting and the thirst and distention of the epigastrium are the chief troubles. Especially is this the case with continual and regular emptying of the stomach. As the days pass, the patient's strength sinks, while the frequency of the pulse increases. At one stroke the whole condition may change. In the course of a few hours the patient can sink into deep collapse, with hollow eyes, shrunken cheeks, cold limbs, and thready and extremely rapid pulse. Sometimes the collapse comes quite suddenly and death occurs in a moment, notwithstanding the fact that the condition hitherto has not been especially disquieting. In severe cases the collapse will occur earlier, and in many of these cases the sudden appearance of collapse is the first phenomenon of the illness

(Bastedo, Borchardt, Braun and Seidel, Haberer, and Leonhardt).

Upon examination of the abdomen one will find that it is tender. The tenderness commences in the epigastrium and extends downward with the increasing dilatation of the stomach, it is, however, of greatest intensity during the beginning of the dilatation, while the excessively distended stomach often is less tender or not at all. As a rule, a distention will be noticeable which has reached some size. The outlines of the stomach are in most cases quite distinguishable. There are, however, cases noted where an excessively distended stomach has not had the slightest influence on the shape of the abdomen. In the ordinary course of things, splashing sounds elicited by percussion or shaking of the abdomen will show that one has to deal with a large collection of fluid or gas in a distended intestine. So excessively may the stomach be distended upward also, that succussion sounds are produced by the heartbeats and occur simultaneously with the movements of the heart (Leonhardt's Case 2). Sometimes the outlines of the distended stomach are indicated by a symptom which gives the highly interesting evidence that the stomach is not paralysed, namely, by *visible peristalsis* (Baillet's Case 1, Baumlér, Bloodgood's Case 1, Braun and Seidel's Case 6, Haberer, Heine-Ewald, Herriek, Lehmann and Stewart). If a stomach tube is introduced in a severe case, gas and fluid will be expelled with great force, often quite as a small explosion, and, especially under the first evacuation, in large quantities. If one is in doubt as to the seat of the distention, one will not remain so, as with the emptying or lessening of the contents of the stomach the distended abdomen collapses.

The contents of the stomach are watery, and in the beginning yellowish or greenish; later they become brown or black with the mixture of blood. From the commencement the fluid is odorless, but becomes more and more offensive, and sometimes fetid, or of a sweetish, nauseating smell, in some cases, but scarcely correctly, called feculent. It contains bile as a rule; otherwise the contents are very different. Sometimes it contains little, sometimes a considerable amount, of free

<sup>1</sup> "Gallensteinkrankheit mit und ohne Ikterus" Berlin 1892

hydrochloric acid; at other times it is without or with abundant lactic acid. In one of Wichern's cases it contained coli bacilli, streptococci and staphylococci. Its bulk is in most cases considerable. As a general rule a single vomiting does not evacuate much, but as the vomiting continues at intervals all day, the quantity vomited becomes a fair amount. The vomiting is often described as profuse, but whether great or little, only a small part of the contents of the stomach is evacuated. Even immediately after a vomiting the stomach tube will evacuate more than several vomitings, and sometimes the first introduction of the stomach tube has removed many litres; for instance, in Neck's first case, directly after a copious vomiting,  $4\frac{1}{2}$  litres, and in Borchardt's case, half a bucketful. It is remarkable how quickly the stomach may refill after emptying. An increased secretion probably takes place in every acutely distended stomach, but in very different degrees. In my first two cases the secretion was not noticeably large, but it is sometimes enormous. Morris considered this the most important point of the condition, and suggested the name "gastroscorrhæa," and Zweifel thinks the stomach's copious hypersecretion characterized by the pictorial remark: "Als wollt' es sich nimmer erschöpfen und leeren, als wollte das Meer noch ein Meer gebären." It is remarkable, therefore, that vomiting sometimes fails to appear. This is not even an unusual event, one certainly does not often find the non-appearance of vomiting directly remarked upon as with Box, Chavannaz, Conner, Delagenière, Legueu, and von Herff (Case 2), but there are several cases in which vomiting is not mentioned (Houston, Nicolaysen, von Herff's Case 1, Braun and Seidel's Case 4, Bloodgood's Case 6, and others). More frequent and easier to understand is the observation that vomiting, which has been present earlier in the illness, ceases the last hours before death.

**Pain** is present as a rule, but is of various severity. It generally confines itself to the epigastrium and umbilical region. In many cases the illness commences with a cry of pain from the patient; sometimes he lies day after day moaning continually. Bull's patient

(my Case 3) lay two days and nights, so to say, in one constant scream; my patient No. 2 complained without pause, while the pain in my first case was unnoticeable as compared with the thirst and vomiting. Absolute freedom from pain is comparatively rare. Conner found, in his casuistic review, the presence of pain mentioned in 42 cases; in 35 of these the pain was said to be more or less severe. The absence of pain was noticed in only 7 cases.

**Thirst** is one of the most constant symptoms, and sometimes it becomes severe beyond description. The patient's craving for something to drink, as for instance in my first case, may be so intense that it is extremely difficult to refuse. And many a surgeon can no doubt say, with Laffier, that the terrible, agonizing thirst which could not be relieved either by saline transfusion, enemata, or by drinking has left the deepest impression on his mind. In connection with the desire for fluid is the decrease of the urine, which can lead to suppression. The quantity of urine is, however, in many cases less influenced by the continual vomiting than one would expect.

The intestinal function seems often to be quite independent of the dilatation of the stomach. It is, as a rule, sedulously noticed in post-operative cases. Flatus and movement of the bowels have often both ceased, and their recommencement is one of the first signs of improvement, but in many cases the dilatation of the stomach is accompanied by diarrhœa. It is of interest to notice that the action of the bowels has been unimpaired, even in several cases where mesenteric compression has been present (Engström, Walzberg, Zade, and Bull). It is thus shown that Braun and Seidel incorrectly consider maintained intestinal function as a proof of free passage through the duodenum.

A rare symptom is *hiccuph*. *Cyanosis* is observed by Leonhardt, Mayo Robson, and Templeton, *giddiness* by Bull and Heine, and *syncope* by Bloodgood.

#### PROGNOSIS

Of 144 cases, 78, or 54 per cent died. Conner's statistics from 1907 show a mortality of 72.5 per cent and Laffier's from 1908 63.5

per cent. One can judge from this that the prognosis, with the sharper diagnosis and earlier treatment, has steadily improved in time. For the 80 cases in my grouping from the time subsequent to Conner's statistics, the death rate has decreased to 36.2 per cent; and apart from 8 of these cases, in which dilatation was treated by operation, and all of whom died, the death rate for my remaining 72 cases from the time after 1907 sinks to 26.2 per cent.

We get, however, a truer picture of the significance of the illness by considering the cases which have not been treated, or only medically. Their number is 31; of these 29 died; Bastedo's patient No. 2 was cured with apomorphin, and Häberlin's case, which was not understood to be dilatation of the stomach, by hypodermoclysis. It is seen that many of the authors who have occupied themselves with this subject presume that the literature does not give a correct expression for the prognosis of the illness; as many lighter and cured cases are not included because they are overlooked. One may be allowed to doubt the correctness of this statement. An acute dilatation of the stomach has not much disposition to spontaneous cure. Among other circumstances, the extremely unfavorable influence of fluids and the patient's agonizing thirst are likely to act in the opposite direction. One can form an opinion of the illness's duration from the outline which is given for 21 of the 31 cases medically treated or untreated, of which 29, as before stated, ended fatally. In 2 cases (Conner's and Nicolaysen's) death occurred in 3 and 5 hours, respectively, after the first symptoms of dilatation; in 9 cases, after 1 to 2 days; in 4 cases, after 2 to 3; and in 2 cases, after 4 days. In 4 cases the illness lasted between 6 and 9 days. The illness, in more than half of these cases, thus came to a fatal end in two days, or even shorter time. With those patients whose stomach had been emptied more or less regularly with the tube the duration of the illness was much more variable, and sometimes was quite protracted. In Herrick's Case 2 death occurred on the twelfth day, in Baumler's very typical case (No. 1) on the thirteenth, and in Kausch's case the sixteenth day after the commencement of the

dilatation. On the other hand, several of the patients who were treated with stomach tube died in less than a day. In several cases the dilatation reappeared after the first food or drink, and in some cases it continued for some time even after the severe symptoms had disappeared. The Rontgen examination of Sommarin's patient showed that the stomach, even after the lapse of a month, reached to 3 cm. below the navel.

*Pathological anatomy.* The stomach is always more or less distended. The distention will sometimes be as in our Case 3, comparatively slight, and show itself principally by the globular shape of the stomach; the latter sometimes extends downward right into the pelvis, very often to the symphysis, under these circumstances, according to Fenger, looking like a huge, bent arm with the elbow near the pelvis.

Between these extremes one finds many variations. The excessively distended wall of the stomach is usually described as quite thin. In Nicolaysen's case the stomach is compared to an inflated pig's bladder, in Leonhardt's and Hanssen-Loberg's cases to a market-balloon, and the contents of the stomach were in the latter case visible through the thin wall. Its color is red or bluish, with lesser distention gray or gray-blue. In the mucous membrane regular extravasations are to be found, and often superficial erosions, which explain why the vomited matter by degrees assumes a hemorrhagic character.

In Thomson's first case the pylorus was obstructed by a tumor. In Kayser's second and Kausch's first case there was a kinking of the duodenum between the horizontal and descending parts. In the older literature one finds, especially in gall-stone cases, several instances of acute dilatation of the stomach ascribed to occlusion of the upper part of the duodenum by adhesions. When the duodenum is mentioned in the post-mortem accounts it is usually described as being distended. The distention has generally been seen to occupy the upper part of the duodenum, while the lower part seems not to have been inspected. The arterio-mesenteric compression at the duodeno-jejunal junction, which plays so important a part in the discussion of the illness'

etiology, is only mentioned by a few authors: P. A. Albrecht, Baumler, Bloodgood (2 cases), Binzwanger, Conner, Engstrom, Finney, Hanssen, Kausch, Lehmann, Leonhardt, Muller (2 cases), Payer, Schmorl, Stieda, Walzberg and Zade. Added to these come 3 cases where arterio-mesenteric compression is noticed during the operation, by Tschudy, Bloodgood and Bull (my Case 3). Baillet, Box and Wallace (cases 2 and 3), Neck, Petit and Wichern have noticed that the dilatation extended to the lower end of the duodenum, but make no mention of a compression by the mesenteric artery. Baillet, Engstrom, and Wichern saw at the duodeno-jejunal junction a *furrow or constriction on the duodenum*; Baumler saw, on the part compressed by the mesentery, a rose-colored stripe on the serosa and corresponding to it a *necrosis in the otherwise normal mucous membrane, 1.5 cm. broad, nearly circular, but superficial*. The fact that the arterio-mesenteric condition has been mentioned in but comparatively few cases can hardly be taken as evidence that compression at the duodeno-jejunal junction has not oftener been present. One is scarcely mistaken in the surmise that a pathologist who does not in his post-mortem account of a case of acute dilatation of the stomach remark upon such a peculiar and, for the illness, significant fact as the arterio-mesenteric compression, either has not been acquainted with it or has neglected the search for its presence. For the remark, that we find only that for which we are looking, can also be applied to a post-mortem.

About the small intestine the literature contains little. When it is mentioned it is generally described as collapsed and lying in the pelvis. It has sometimes been noted that the mesentery was exactly so long, that the small intestines hung down into the pelvis, and in this way causing that pull on the mesentery and the mesenteric artery which produces the compression of the duodenum between the mesentery and spine. In a group of collected cases and in those above mentioned an increased lordosis was noted, on which the duodenum was thought to ride, thus becoming linked or compressed

#### TREATMENT

The treatment is not the least interesting chapter in this peculiar, and formerly nearly always fatal, illness. In the rapid development therapy has undergone in the last fifty years, restoration to health has taken place in a great number of cases which formerly would have been more or less hopeless. The greatest triumphs are achieved by operative surgery. With the acute dilatation of the stomach, however, this has been obliged to admit defeat; on the other hand, results which can compare with surgery's best have been attained by the simplest means.

Among prophylactic measures, too energetic preoperative evacuations of the intestine are cautioned against, and probably with good reason. The danger herewith is presumed partly to be in the debilitation of the patient, partly in so thorough an emptying of the small intestine that its sinking into the pelvis, with following tightening of the mesentery, is favored. It is of great importance, both after operation and during convalescence, to be extremely careful with food supplies in abundance. This rule, correct both in fact and practice, was earlier upheld by Laache. Of the worth of subcutaneous strychnin injections before laparotomies, which by some surgeons are systematically used, I do not venture to express an opinion.

If the dilatation has first developed, one can hardly hope for results from internal remedies. All those remedies which were suggested in former years, when the illness was first known, have now none but historical interest. Among these are atropin, ezerin, morphia, strychnin and apomorphin. It is doubtful if hormonal, which recently has been tried, is of any greater value. Faradization and cold compresses, which in the sixties and seventies were recommended by Furstner<sup>1</sup> and Erdmann,<sup>2</sup> are likewise obsolete remedies.

It is certainly true that a subcutaneous injection of apomorphin in Bastedo's Case 2 seems to have produced a life-saving emptying of the stomach, but for the evacuation of the overcharged stomach we have an easier remedy in the stomach tube. An energetic and

<sup>1</sup>Berl klin Wchnschr 1876 142

<sup>2</sup>Varbow's Arch Bd 43 289

continual evacuation by the tube has become the principal resource in a case of acute dilatation of the stomach. And with reason. Nothing is more rational than to unload the overcharged and strongly hyper-eccerning stomach, and it is obvious that the sooner and oftener this is done the more satisfactory is the result. If the evacuation takes place only after the stomach is distended to the maximum and the patient's strength has sunk in the extreme, the diminution attained, even the momentary total evacuation of the contents of the stomach, will often be in vain. An early and complete emptying are alike desirable. Often, however, this is accomplished with difficulty. The greatly distended stomach is full of gas and fluid, and the latter will, when the patient is lying in bed, mould the thin and yielding stomach to the excavations of the posterior abdominal wall. To bring the tube under the surface of the fluid is, under these circumstances, not always easy. One has to try tubing with the patient lying in different positions. Elevation of the pelvis, for instance, is often necessary to drive the fluid higher up in the abdominal cavity. That one must also insert the tube much deeper than usual is evident. Delagenière, Houston and Lehmann introduced the stomach tube in vain, with Bloodgood's patient its introduction had to be given up on account of the alarming symptoms it caused, and von Herff met with an obstacle in the cardia, which was only overcome by the use of a stiff tube. A correct and consistent tube treatment must, however, be supported in different ways. To this belong reasonable stimulation of the heart and a compensation for the patient's enormous loss of fluid by giving intravenous, subcutaneous, or rectal infusions.

It seems to be a generally accepted view that the treatment with the stomach tube affords sufficient help for curing an acute dilatation of the stomach. This opinion is urged, by Braun and Seidel among others; and Haberer declares that the often serious cases of this illness which in the course of time have occurred in the first surgical clinic in Vienna are all cured, and mostly in this way. Neither he nor Korte have seen an unsatisfactory result in an uncomplicated case of primary post-

operative dilatation of the stomach. I have, however, much difficulty in adopting so optimistic a view of the effect of the tube treatment. I am prevented therefrom by the knowledge gained both from the literature and from my own experience.

Of the 48 patients in this summary treated by stomach tube, 24 were cured and 24 died (Table I). The high death rate in a number of cases similarly treated during recent years must arouse a doubt as to the efficacy of the treatment even under favorable circumstances. It is difficult to believe that such severe complications have been present in half the number of cases, or so deficient a use of an otherwise effective measure, that this has altogether failed. There are also among these 24 fatal cases some which go to show that even in an uncomplicated case a satisfactory result is not necessarily attained by an evacuation of the stomach even if it is begun early and continued twice daily. To this class belongs, for instance, von Herff's case (No. 2), where at the post-mortem there was found no other cause for death than the considerable but uncomplicated dilatation of the stomach. Although a post-mortem is wanting, Laffer's second case also seems likely to arouse some doubt as to the absolute efficiency of the stomach tube. This doubt is increased by considering those cases in which the tube was used without result, though change of posture brought instant relief. Among these I must specially mention Walzberg's case and my Case 1. In these cases the emptying commenced 12 and 8 hours, respectively, after the first symptoms of the dilatation; in both cases evacuation was continued, morning and evening, for two days, but with the reverse of improvement, and in both cases change of posture was effective at once. On the whole, we find many cases, described in more or less detail, in which an early tube treatment led to no result. Here, among others, belongs Baillet's patient, operated upon later, and also the same author's two cases which were treated by the stomach tube alone.

Upon consideration of the tube-treated cases collected in Table I, another fact will be noticeable. This is, that the result of a late

TABLE I—CASES TREATED BY STOMACH TUBE

Reference	Sex and Age	Previous Condition	Dilatation when	Incidental cause	Stomach tube first used, when	Result	Remarks
P. A. Albrecht	F 30	Tuberculosis, Resection cubiti	4th day		6th day	Died 10th day	Post-mortem: Arterio-mesenteric compression
Albu	M 35	Scarlet fever	11th day	Gluttonous appetite had returned	15 hrs. after dilatation	Died 20 hrs. later	Post-mortem: Stomach enormously distended.
Bailet	F	Ovariectomy			Directly after dilatation	Died 8th day after operat.	
	F	Cholecystectomy			Directly after dilatation	Died 8th day after operat.	
Bäumler	M 25	Typhoid fever	5th week	Appetite quickly increased	25 hrs. after dilatation	Died 15 days later	Post-mortem: Arterio-mesenteric compression. Furrow on serosa, circular necrosis of mucosa
Beck	M 25	Appendectomy	5d day		24 hrs. before dilatation	Cured	
Burnbaum	F 45	Hystero-myomectomy	4th day		6-8 hrs. after dilatation	Cured	Condition seemed hopeless. Unexpected improvement 9th day
Woodgood (V.)	M 57	Inguinal hernia. Radical operation	Very quickly		Soon after dilatation	Cured	Castor oil was found in the stomach after 22 hrs.
Borchgrevink (V.)	M 20	Nephrectomy	2d day		Soon after dilatation	Died 3 d day	
Braun and Seidel	F 30	Salpingotomy	3 1/2 days after operat.	Extreme thirst, drank much	35 hrs. after dilatation	Cured	
Braun and Seidel	F 28	Salpingotomy	2 1/2 days after operat.	Patient drank very much	60 hrs. after dilatation	Cured	
Braun and Seidel	M 50	Appendectomy	1 day after operat.	Severe thirst, drank much	4 to 5 hrs. after dilatation	Cured	
Braun and Seidel	M 45	Appendectomy	3 days after operat.	Plenty of wine and water taken	1 to 3 hrs. after dilatation	Cured	Vomiting not mentioned
Braun and Seidel	F 45	Cholecystotomy	2d day	Ill directly after first solid food	Shortly after dilatation	Cured	
Braun and Seidel	M 14	Cretrotomia externa	4th day		Directly after dilatation	Cured	Gastric peristalsis visible
P. Bull	M 17	Amputation cruris	2d day		3d day	Cured	
Engström	F 45	Hystero-myomectomy	4th day	Ill after hearty dinner	24 hrs. after dilatation	Died	Death directly after evacuation. Arterio-mesenteric compression
O. Hansen	M 33	Diabetes			8 hrs. after dilatation	Died 12 hrs. later	
Henne	M 34	Good health		Ill after 3 or 4 bottles of clam-pie etc.	5 hrs. after dilatation	Cured	At the beginning of dilatation much distress.
Henne Ewall	M 16	Reconvalescence after typhoid fever		Excess in drinking	25 to 30 hrs. after dilatation	Cured	Gastric peristalsis visible
Hellendahl	F	Intra-abdominal shortening of round lig. anemias	3d day		Directly after dilatation	Cured	
v. Herff	F 40	Supravaginal hysterectomy	5th day		Shortly after dilatation	Cured	
v. Herff	F 43	Vaginal hysterectomy	2d day		4th day	Died 8th day	No vomiting. Only a stiff stomach tube could be introduced. Evacuation twice daily
Herrick	F 55	Cholecystectomy	3d day		?	Died 14th day	
Kausch	F 13	Spondylitic paraplegia	Ill the day after introduction of weight extension		24 hrs. after dilatation	Died 15 days later	Post-mortem: Arterio-mesenteric compression caused by lifting of the uppermost jejunal coil

TABLE I (CONTINUED)—CASES TREATED BY STOMACH TUBE

Reference	Sex and Age	Previous Condition	Dilatation, when	Incidental cause	Stomach tube first used, when	Result	Remarks
Kayser	F 37	Intestinal anastomosis, etc.	7th day	Ill after having drunk a quantity of buttermilk	Shortly after the dilatation	Died 8th day	Post mortem Enormously distended stomach. Duodenum kinked below the liver
Kurch	M 19	Delicate kyphoscoliotic		Ill directly after supper of 3 platefuls of bread soup	4 days after dilatation	Died 24 hrs later	Exploratory aspiration of the stomach
Laffer	M 17	Empyema of antrum of Highborn drained	13th day	Had lately taken a large amount of milk and water	Directly after dilatation	Died 16th day	Stomach tube used regularly twice daily until death
Laffer	M 33	Appendicitis operation	24 hrs. later			Cured	
Laffer	M 36	Paraplegia syphilitica			The day after the dilatation	Died 24 hrs. after dilatation	Post mortem Gastric but not duodenal dilatation
Landahl	M 43	Good health		After exertion plenty of water and raw fruit	43 hrs after dilatation	Died 15 hrs. later	
Leguru	F 30	Nephrectomy	3d day		7 hrs after dilatation	Died 6th day	No vomiting
Leonhardt	M 30	Pneumonia	16th day		4 days after dilatation	Cured	By stomach tube, enormous quantities evacuated
Leonhardt	M 20	Pneumonia	9th day		2 days after dilatation	Died 12th day	Spashing sounds coincident with the movements of the heart
P Müller	F 64	Cholecystostomy	2d day		1 day after dilatation	Cured	Stomach distended toward pubes
Neck	M 16	Rather delicate		Ill after having eaten much raw fruit	5 days after dilatation	Cured	Directly after copious vomiting 450 litres evacuated by stomach tube
Neck	F 40	Kyphoscoliotic, but healthy		The dilatation was unexplainable	8 days after dilatation	Cured	First evacuation gave 2 litres
Neck	M 41	Tuberculous kyphoscoliotic	Shortly after supper	Two platefuls of buttermilk for supper	3 days after dilatation	Died 5 hrs later	Exploratory aspiration First evacuation gave 3 litres
Neck	M	Tuberculosis		After dose of veronal		Cured	
Payer	F 33	Nephrectomy	6th day	Ill after an orange	7th day	Died 8th day	Post mortem Arterio-mesenteric compression
Robson (V)	F	Cholecystostomy	7th day		1 to 2 days after dilatation	Cured	Collapse, cyanosis anuria
Robson (VI)	F 20	Hysterectomy	14th day	Ill after a raw apple	2 days after dilatation	Cured	Stomach distended to the pubes
Schilling	F 40	Hysterectomy	2d day		Shortly after dilatation	Cured	Condition for 8 days seemingly hopeless, then sudden improvement
Thom	F 34	Tubal pregnancy, laparotomy	3d day		4 to 6 hrs after dilatation	Cured	3th day, new dilatation after food
Thomson	F 32	Confinement	6 hrs after delivery		Directly after dilatation	Died 6 hrs later	
Walzburg	F 27	Hepatic abscess drained	2d day		25 hrs after dilatation	Died 8th day	Post mortem Gastro-duodenal dilatation, arterio-mesenteric compression
Wichers	F 77	Typhoid fever	21st day		20 hrs after dilatation	Died 23d day	Post mortem No furrow on duodenum as in Wichers's first case
Zade	F 32	Gastro-entostomy	3d day		8 hrs after dilatation	Died 2 hrs later	Post mortem Arterio-mesenteric compression, excessive dilatation



commenced tube treatment is not always as bad as might be expected. Braun and Seidel's Case 2, Leonhardt's Case 1, and Neck's cases 1 and 2, in which treatment by the tube seems to have commenced about 60 hours (4, 5 and 8 days, respectively) after the first symptoms of dilatation, are instances of this kind ending favorably. Kelling's case, so accurately observed and described, also belongs to this class, inasmuch as restoration to health must rather be ascribed to the gastric lavage than to the change of position. The evacuation commenced, as the author explicitly states,  $3\frac{1}{4}$  days after the onset of the dilatation. The impression which these observations leave is that the effect of the evacuation of the stomach not only depends upon early, continual and complete execution, which are a matter of course with every sort of treatment. On the contrary, it seems reasonable to suppose that special anatomical or functional conditions may be present or have reached such a development that they destroy the effect of the tubing in one case, but not in others. And one asks involuntarily if it may not be the duodenal occlusion, to which under the etiology we again and again return, which, once developed either alone or in connection with gastric hypersecretion, annuls the results of the stomach tube treatment in some cases.

In former days one felt obliged to operate the patient when the treatment with the stomach tube proved inefficacious. If we look at the results attained by operative treatment for acute dilatation of the stomach, we meet with no encouragement.

There are 4 groups of operations in 5 cases, gastro-jejunostomy, partly with anterior and partly with posterior anastomosis, and in 11 cases, gastrotomy or gastrostomy. Jejunostomy has been performed once, and a last group comprises 6 cases treated by laparotomy, with or without evacuation of the non-incised stomach, or with undoing of a duodenal compression. To this last group Borchardt's and Bull's patients (my Case 3) properly belong. On account of the postural treatment instituted after the operation, however, these two cases are recorded among those treated by change of position (Table III).

The cases treated by gastro-enterostomy are Baillet's, Korte's, Remond's, Robinson's, and Tschudy's. Among these, the dilatation in Baillet's and Tschudy's cases was post-operative, after exarticulation of the arm and resection of the pylorus; in Korte's case it developed after overloading of the stomach in a formerly healthy individual. In the other cases, there is no information as to the origin of the dilatation. Of all of them, Robinson's patient is the only one who lived; the other 4 are dead. Baillet's patient died 12 hours after the gastro-enterostomy; Korte's, after 5 days' promising convalescence and as a result of a perforated necrotic spot in the stomach, Tschudy's patient survived the last operation 11 days, dying of pneumonia. The accompanying circumstances give a certain explanation for the different results. Both Korte's and Tschudy's patients were operated upon shortly after the onset of the dilatation, while in the case of Baillet's patient the dilatation had lasted 4 days before gastro-enterostomy took place. Bloodgood's patient, who was reconvalescent after acute rheumatism and in whom dilatation was presumably caused by overloading of the stomach, died two hours after the jejunostomy.

Gastrostomy was performed on Appel's, Abbott's, Box and Wallace's, Brown's, Hoffmann's, Hanssen-Loberg's, Kehr's, Schilling's, Sommarin's, and Watson and Wright's patients. Of these, Appel's and Box and Wallace's patients had acquired the dilatation after a blow on the abdomen; Hanssen-Loberg's and Sommarin's patients, after a more or less hearty meal, Kehr's and Schilling's, after gall-stone operation and gastro-enterostomy, respectively, and with Brown's patient, who up to the acute dilatation of the stomach had been quite well, no cause for the development of the illness could be traced. Appel, Box and Wallace, and Loberg incised, emptied, and closed the stomach and the abdominal wound. Hoffmann, Sommarin, and Schilling left a drainage tube in the incision of the stomach; the latter led the tube farther through the gastro-jejunal anastomosis, which was established before the onset of the acute gastric dilatation, and Brown stitched the edges of the incision in the stomach to those

TABLE II.—CASES TREATED BY OPERATION

Reference	Sex and Age	Previous Condition	Incidental cause	Operation	Result	Remarks
Abbott				Gastrostomy	Death	
Appel		Of good health	Abdominal injury		Died 36 hours later	The stomach was incised, emptied and closed. Second night, new dilatation, shortly afterwards, death
Bailet	M 15	Exarticulation humeri	3d day, suddenly ill after café au lait	7th day gastro-jejunostomy	Died 22 hours later	Gastric peristalsis. Despite regular evacuation with stomach tube, progressive deterioration. Circular furrow on the duodenum
Bloodgood	M 25	Reconvalescent after acute rheumatism	Ill after first real meal	Jejunostomy 4th day	Died 2 hours later	Gastric peristalsis. Arterio-mesenteric compression
Bot and Wallace	M 16	Of good health	Abdominal injury	Gastrostomy	Death	Laparotomy for intestinal obstruction. The stomach was incised, emptied and closed
W. H. Brown	M 55	Of good health	Dilatation unexplainable	Gastrostomy	Death	Laparotomy for intestinal obstruction showed a "cyst" which was incised and drained. Post mortem the incised cyst proved to be the stomach
B. Robinson				Gastro-jejunostomy	Cured	"B. R. has reported a cure after gastro-jejunostomy" (Laffer)
Hochenegg	M 22	Of good health	Suddenly ill after hearty meal	Laparotomy 3d day	Died 2 days later	The jejunum was lifted and the compressed duodenum relieved. After short relief new vomiting. Arterio-mesenteric compression
Hoffmann	M 18	Of good health	Severely ill directly after dinner	Gastrostomy 6th day	Died 24 hours later	The stomach was incised, emptied, and drained
Jacop	F 26	Hip-joint resection	30th day suddenly ill after having eaten an apple	Laparotomy 34th day	Died few hours later	The operation was only explorative
Kehr		Gallstone operation		Gastrostomy	Death	Died 2 days later from hemorrhage
Körte	F 14	In good health	Ill after big meal eaten in haste	Posterior gastro-enterostomy	Died 5th day	Evacuation by stomach tube proved impossible. For 3 days quite well. Sudden death from perforating gastric necrosis
Hanssen-Löberg	M 15	Good health	Ill one hour after big meal eaten in haste after exertion	Gastrostomy 3 to 4 hrs later	Died the next day	Two evacuations by stomach tube. The stomach was then incised, emptied and closed. Death after short relief. Excessive dilatation
Moorhead	F 22	Perineorrhaphy, oophorectomy appendectomy		Laparotomy. Stomach emptied by tube	Cured	After the perineorrhaphy a large tumor suddenly formed in the abdominal cavity. Laparotomy. The tumor proved to be the distended stomach, which was emptied by tube
Petit				Laparotomy	Cured	A kinking at the duodeno-jejunal junction was relieved by the stitching of jejunum to transverse mesocolon
Remond				Anterior gastro-jejunostomy	Death	
Schilling	F 25	Posterior gastro-enterostomy		3d day jejunal anastomosis, 8th day gastrostomy	Died 16th day	After the gastrostomy a drain was led through the gastro-jejunal anastomosis into the jejunum
Sommann	F 15	Good health	Excessive amount of raw fruit. Next day 3 bottles of mineral water	Witzel's gastrostomy 2d day of illness	Cured	
Templeton	F 28	Dyspeptic otherwise healthy	Ill after a railway meal	Laparotomy	Cured	The greatly distended stomach emptied itself during the operation without being incised or pumped
Tschody	F 47	Kocher's pyloroplasty		Gastro-jejunostomy	Died 16th day	Continual post-operative vomiting. Fifth day, gastro-jejunostomy. No later gastric symptoms. Death from pneumonia
Wahlström	M 17	Delicate	Suddenly ill after breakfast	Laparotomy 5th day	Died 10th day	The exposed stomach was emptied by trocar. After the operation, regular use of stomach tube
Watson				Gastrostomy	Died	
Wright				Gastrostomy	Died	

of the abdominal wound. Appel's patient died some 36 hours after the operation, under repeated dilatation, Brown's died 5 hours and Hoffmann's one day after the gastrostomy. Schilling's patient lived 8 days after the last operation under continual evacuation of the stomach with the tube. Sommarin's patient is the only one who was cured.

The 6 cases treated with laparotomy and without incision of the stomach underwent otherwise a different treatment. Jessop seems to have performed only an exploratory laparotomy, which a few hours later was followed by death. While the abdominal cavity was open, Moorhead (as also Borchhardt) emptied the stomach with a tube, Wahlstrom with trocar. Moorhead's patient recovered under continued treatment with the stomach tube; Wahlstrom's died after the lapse of 5 hours. Templeton lifted the stomach, the contents of which therewith spontaneously went over into the intestine; his patient recovered. Hoehenegg relieved the duodeno-jejunal occlusion by lifting the upper jejunal loop, and seems to have confined himself thereto; his patient died 2 days after the operation under renewed dilatation and vomiting; Petit performed the same maneuver, but stitched the jejunum to the transverse mesocolon, and this seems to have prevented a new occlusion; the patient recovered. The satisfactory result in Moorhead's case is the more easily explainable in that the laparotomy which was performed took place under the same narcosis as that which is presumed to have occasioned the dilatation. Templeton's patient seems also to have come early under treatment. On the other hand, Hoehenegg's, Jessop's and Wahlstrom's fatally ending cases, all similar in so far as dilatation seems to have been occasioned by food, are operated first on the third, fourth, and fifth day of illness.

We thus see that of 23 operated cases 5 survived, 1 after gastro-enterostomy, 1 after gastrostomy, and 3 whose stomachs were emptied during a laparotomy. Even if the operative result in Korte's and Tschudy's cases is considered satisfactory, gastro-enterostomy does not appear in any flattering light. It seems reasonable to agree with Borchardt, who declares such an operation irrational.

In the commencement of the illness, while gastro-enterostomy could have a chance, one can attain a good result with simpler measures; and at a later stage of the illness, the difficult manipulation of the perhaps excessively distended stomach makes gastro-enterostomy a too serious operation for the collapsed patient. As Zade's, Schilling's and von Haberer's cases show, an acute dilatation of the stomach can both develop and continue notwithstanding an already performed gastro-enterostomy. Gastrostomy, which one would consider much less dangerous, has in the 11 cases collected here given even worse results than gastro-enterostomy. Lastly, as regards the performed laparotomies, they have, as might be expected, been somewhat more successful than the more radical operations. They have, however, proved themselves both unnecessary and dangerous. The stomach can be emptied without laparotomy. The conclusion one comes to upon considering the result of all the operations performed is that success with operative measures, in a still higher degree than with any other treatment, depends on the stage of the illness in which the operation takes place.

After the discouraging experience gained one can foresee that operative treatment of the acute dilatation of the stomach in the future will rarely be employed. Byron Robinson's suggestion of a duodeno-jejunal anastomosis in front of the mesenteric vessels and H. Albrecht's and Rosenthal's proposal of shutting off the pelvis by uniting the sigmoid flexure with the urinary bladder are hardly more suited to rehabilitate operative measures in the acute gastric dilatation than the recommendation of stitching the root of the mesentery to the transverse colon.

If we turn from operation to the treatment of acute dilatation of the stomach by postural treatment, things take at once a brighter outlook. First we meet with 26 cases in which the patient is turned completely over in bed. Among these is also included Box's patient, who was laid "semi-prone," on the right side. Of the others, the 23 have chiefly lain in Schnitzler's abdominal position; only 2, Engstrom's and Weinbrenner's, patients were laid in knee-chest and knee-elbow posi-

tion, respectively, which positions are suggested by Albrecht for the elevation of the pelvis.

The results are as follows: Of 26 treated patients, 2 are dead, Borchardt's and Nakahara's. With the first the abdominal posture proved unfavorable, in the last it seems to have been effective.

The first, a female aged 17, was quite well until 52 hours after a nephropexy, almost as if she had not been operated. Then she collapsed suddenly. A small explorative laparotomy was performed, which showed an enormous dilatation of the stomach. With the stomach tube  $\frac{1}{2}$  bucketful of fluid mixed with bile was emptied. The next morning the patient was somewhat better and was laid prone in bed, but after this she became "foudroyant" worse and died a few hours later, 23 hours after the first symptoms of dilatation and 75 hours after the nephropexy. Post-mortem the stomach was found distended right to the symphysis.

With Nakahara's patient, a female aged 29, hepatico-jejunostomy was performed June 10, 1908. June 11, severe vomiting of greenish fluid after evacuation of the stomach and subcutaneous and rectal saline infusion. The patient was laid partly on the abdomen, and partly on the right side. June 12, condition considerably better. June 13, patient felt well, and drank milk and soup. All was now well until June 19, when the patient suddenly collapsed, bile and intestinal contents escaping through the wound. The patient died June 25. Post-mortem the stomach showed only slight dilatation. The suture line between the hepatic duct and the jejunum had given way, and besides an aneurysm of the hepatic artery had burst into the anastomotic aperture and filled the upper part of the small intestine with blood.

In two cured cases, Hellendahl's and Kayser's, the abdominal position was without result. In the first of these cases it was abandoned after a short while on account of pain, and was tried the next day for only half an hour; three days later the gastric symptoms spontaneously ceased. The other case seems to have been a dilatation of the stomach occasioned by meat-poisoning, where nine days elapsed without effect from any measure tried—stomach tube, various positions, etc. But when, on the tenth day, the patient was moved to another division, she became suddenly well for no known reason. A likewise sudden and unexplainable improvement was noted with Schilling's tube-treated patient after eight days in a dangerous condition.

In the other 22 cases, the abdominal posture has oftener, in the presence of threatening symptoms, and partly when longer treatment by the stomach tube had been without result, brought about a noticeable, often a surprising, effect, and occasioned the beginning of return to health (see Table III).

Of the 6 patients treated by side posture, one, Nakahara's is dead, the other 5 are cured. Chavannaz's, Payer's and Walzberg's patients were laid on the right and Kelling's on the left side; on which side Nakahara's and Herrick's patients were placed is not mentioned. In Nakahara's fatal case side posture was tried only for a short time; in Herrick's and Kelling's cases, which recovered, it did not, at any rate, have a decided effect; in the 3 cases laid on the right side, however, the effect was satisfactory, in Walzberg's case even excellent, and as prompt as the abdominal position can produce it.

It will thus be seen that the abdominal posture in 22 of 26 cases has proved efficacious; in one case (Borchardt's) it seems to have done harm, and in 2 cases (Hellendahl's and Kayser's) to have been without effect. Both the last named, however, are not typical cases of dilatation of the stomach, and thus can hardly be used as a basis for judging the value of the abdominal posture for the treatment. The effect of the side posture has been scarcely noticeable in 4 out of 6 cases; position on the right side has in 3 cases proved very satisfactory (see Table IV).

By the perusal of the history of the recorded cases one will find, however, that the favorable result of the abdominal posture in a case of acute gastric dilatation does not belong to the common round. It is, of course, not always alike conspicuous, but on the other hand the immediate result of the change of position has astonished one observer after another, and Weinbrenner's, Rosenthal's, H. Albrecht's and Landau's description of the equally complete and rapid change in the condition of the patient from the moment he was placed on the abdomen proves beyond doubt that one under these circumstances can meet with an effect which is most unusual. And so it is. In my second and third cases the abdominal posture was adopted rather

TABLE III—CASES TREATED BY ABDOMINAL POSTURE

Reference	Sex and Age	Previous condition	Dilatation when?	Stomach tube first used	Abdom. posture when?	Result	Published	Remarks
Schnitzler		Operat. for inguinal hernia	1st day		3d day	Cured	1895	Serious condition. In abdom. posture, relief.
P. Müller	F 32	Cholecystectomy	1st day	2d day	3d day	Cured	1900	In abdom. posture immediate and total change despite much fluid. On the back new vomiting. Patient is comfortable in abdom. posture.
Baumler	M 36	Sciatica	1 day after dilatation		1 1/2 days after dilatation	Cured	1901	Knee elbow position 1/2 hour every other hour, meanwhile abdom. posture as much as possible. The vomiting stopped at once. By new tubing stomach proved empty. Quick recovery.
Dox	F 27	Ovariectomy	3d day	3d day	4th day	Cured	1903	Patent was placed 'semi prone' on the right side. The effect was apparent at once.
Borchardt	F 17	Nephropexy	52 hrs. after operation	Directly after dilatation	1 day after dilatation	Died	1904	Stomach tube inserted during explorative laparotomy 22 hrs. after the nephropexy. In abdominal posture, next day patient got 'foudroyant' worse and died few hours later.
Robson	F 58	Ovariectomy	20 hrs. later		25 hrs. after operation	Cured	1904	In abdom. posture patient declared herself relieved almost immediately.
H. Albrecht	F 37	Colporrhaphy, ovariectomy	3 1/2 days later	Directly after dilatation	Shortly after dilatation	Cured	1907	Suddenly ill after exerts in fluids. Result of abdominal posture prompt and surprising. Patient maintained it with pleasure.
Kayser	F 20	Meat poisoning	4 hrs. after the meal	4 to 5 hrs. after dilatation	5th day after dilatation	Cured	1908	Stomach tube and different changes of posture. Abdominal, knee-chest, elevated pelvis without effect. Tenth day of illness patient was moved to another division. Sudden improvement.
Landau	F 38	Hysteromyomectomy	3d day	3d day	6th day	Cured	1908	In abdom. posture instantaneous and in the highest degree surprising change of general condition. Sudden relief and acute recovery from an apparently hopeless state.
Landau	F					Cured	1908	Cured by abdominal posture alike quickly as previous case.
Lichtenstein	F 41	Laparotomy etc.	9th day	10th day	10th day	Cured	1908	Suddenly ill after a bottle of Apollinaris in abdominal posture, relieved at once but feeble. Next day well.
Nakahara	F 29	Hepaticojejunostomy	1st day	2d day	2d day	Died	1908	In abdom. posture all went well till 9th day. Then intestinal hemorrhage and fistula. Death 15th day.
Rosenthal	F 37	Hysteromyomectomy	3d day	4th day	5th day	Cured	1908	Suddenly and severely ill after 5 1/2 litres coffee. Most striking effect of abdominal posture. 'It seems incredible that an illness in 1 hour can improve so.'
Bailet	F 30	Ovariectomy	2d day	5th day	8th day	Cured	1909	In abdominal posture quick recovery from a menacing condition.
Delagenière	M 62	Herniotomy	16 hrs. later	Failed	24 hrs. after operation	Cured	1909	The utterly exhausted patient feels very comfortable in abdominal posture and improves hourly. After lying prone the whole night his aspect is completely changed.
Engström	F 59	Ovariectomy	3 1/2 days later	5th day	5th day	Cured	1909	Ill after heavy supper. For 20 minutes placed on knees and chest with instantaneous relief, then on the right side.
Haberer	F	Gastroenterostomy	15th day	15th day	15th day	Cured	1909	Gastric lavage without effect such was at once produced by abdominal posture.
Theilhaber	F 31	Sectio Cæsarea	3d day	3d day	5 1/2 days after operation	Cured	1909	The violent vomiting stopped promptly in abdominal posture. Patient improved hourly, remained prone for 16 hours and liked the position.

TABLE III (CONTINUED)—CASES TREATED BY ABDOMINAL POSTURE

Reference	Sex and Age	Previous condition	Dilatation when?	Stomach tube first used	Abdom posture when?	Result	Pub lished	Remarks
Wienbrenner	F 37	Ventrosixatio uteri	1st day	12 hrs after dilatation	36 hrs after dilatation	Cured	1909	In a state of impending danger abdominal posture gave instant relief and gradual improvement. Patient insisted upon remaining prone, she felt well thus.
Hellendahl	F 24	Salpingotomy		Directly after dilatation		Cured	1910	Patient could not endure abdominal posture. It was again tried for 36 hour the next day.
Payer	F 23	Hysterectomy after birth	4th day	4th day	5th day	Cured	1910	Patient was quickly relieved by abdominal posture alternating with knee-chest position.
Borchgre-vink	F 53	Cholecystec-tomy	3d day	8 hrs after dilatation	23½ days after dilatation	Cured	1912	Ill after much fluid. Gastric lavage twice daily for 3 days without effect. Patient, who appeared to be dying, improved as by a miracle in abdominal posture.
Borchgre-vink	F 27	Salpingotomy	2d day	24 hrs after dilatation	30 hrs after dilatation	Cured	1912	Ill after much fluid. The severe pain and vomiting were at once relieved by abdominal posture, which the patient wished to continue.
Borchgre-vink	M 43	Laparotomy	2d day	12 hrs after dilatation	36 hrs after dilatation	Died	1912	The symptoms of acute gastric dilatation vanished promptly in abdominal posture. Patient was well for 12 days, when he was taken ill and died 7 days later from pneumonia.
Borchgre-vink	M 9	Appendicitis operations	19th day	Not used	60 hrs after dilatation	Cured	1912	Laparotomy without effect, 12 hrs later prone posture brought immediate relief. Patient, for 3 days nearly wild from pain, became quiet and happy.
Borchgre-vink	M 65	Cholecystitis, not operated	Shortly after the first food taken	Not used	14 hrs after dilatation	Cured	1912	Abdominal posture had a striking effect.

early. Both patients were certainly in a serious condition, but the illness had not reached an extreme degree. The effect of the prone position was in both cases prompt and striking. My first patient, on the other hand, who was placed in abdominal posture about 60 hours after the onset of the dilatation, and at a moment when she seemed to be past recovery, was cured in the most dramatic manner. The same was experienced in my case No. IV, treated by Dr. Bull. I have often wondered whether I have ever witnessed a sudden and continued therapeutic effect which can compare with that which the abdominal posture brought about in my first case. But to this I have always had to reply in the negative. According to my experience, even Landau's comparison with the effect of the reduction of a strangulated hernia is insufficient. Herein I imagine everyone who has witnessed the effect of the abdominal posture in a desperate case of acute dilatation of the stomach will agree. When Braun and Seidel write thus: "Von der Bauch oder Knie-

Ellenbogenlage mochten wir meist nicht viel erwarten," it only proves their non-experience of such an event. The unsatisfactory effect of the abdominal position in Borchardt's case, the author himself, in contrast to others, considers of no importance, but finds the result explained by too late diagnosis. In Bull's first case, in nearly every respect a parallel to Borchardt's, change to a prone position had an effect as striking as ever.

#### ETIOLOGY

Although my article was originally intended only to comprise the treatment, I cannot neglect to mention the greatly discussed etiology of the acute gastric dilatation. The observation of the instantaneous effect of the abdominal posture, which has much of the character of an experiment, compels one involuntarily to a consideration of the etiological question based on personal experiences, and to the study of the literature on the topic. It appears to me that a functional disturbance like acute dilatation of the stomach is better explained

TABLE IV. CASES TREATED BY SIDE POSTURE

Reference	Sex and Age	Previous condition	Dilatation when?	Stomach at first used	Side posture first tried	Result	Postulated	Remarks
Kelling	F 10	Plaster jacket applied	3 days later	12 hours after dilatation	Left side posture	Cured	1900	12-16 hours after lay down. Packed in the left side. Movement under control, good gastric lavage.
Walberg	F 43	Explorative Laparotomy	35 hours later	12 hours after dilatation	Left side posture	Cured	1901	Despite gastric lavage took daily postural position and vomited. 12-16 hours side posture relieved condition.
Herrick	M 35	Pneumonia	9th day	1 day after death	Left side posture	Cured	1904	Which side posture not necessary. Local movement under gastric lavage through daily for 4 to 5 days.
Chavannes	F 40	Abdominal Hysterectomy	9th day	12 hours after dilatation	Left side posture	Cured	1905	Right side posture put an end to the vomiting.
Naka-bara	F 31	Torsion of uterus	10th day	15th day	Left side posture	Cured	1908	Side posture of 15th to 20th day and vomiting ceased. Still day motion death during the first gastric lavage.
Payer	M 4	Appendicitis operation	2d day	1 day after operation	Left side posture	Cured	1911	The disposition to dilatation ended only a few days after the removal of the abdominal organ.

by clinical observations than by the numerous experiments on animals and studies on corpses.

The principal hypotheses to explain the development of the acute dilatation of the stomach are the following:

1. *Paralysis of the stomach.* This is the oldest and most generally accepted explanation. It is first asserted by Brinton<sup>1</sup> in 1859 and later maintained up to this time, and last with great emphasis, by Braun and Seidel in their clinical and experimental investigations from 1907.

2. *Primary mechanical occlusion of the duodenum with secondary dilatation of the stomach.* The compression of the duodenum under the mesentery was described by Kundrat<sup>2</sup> as a special form of high strangulation, and its significance as a primary cause supported by P. Müller.

3. *Primary gastric dilatation, best by neuro-musculo-paresis, and secondary mechanical occlusion of the duodenum, either (a) by the distended stomach's direct pressure on the duodenum in its passage over the spine (Box and Wallace) or (b) by a secondary arterio-mesenteric compression brought about by the distended stomach's pressure on the small intestine.*<sup>3</sup>

Several other hypotheses have besides been

<sup>1</sup> Brinton. Lectures on diseases of the stomach.

<sup>2</sup> Kundrat. Wien med. Wchnschr., 1891, no. 2.

<sup>3</sup> Kasper asserts, supported by his second case, that the secondary occlusion of the duodenum does not take place in its lower but in the upper part. A duodenal kinking in Kausch's first case also had its seat in the same place.

suggested which have met with less favor. Albrecht, Glénard and Robinson have considered a *pre-existing chronic dilatation of the stomach* to be the primary factor. Tagge and later Morris saw in *gastric hypersecretion*, and Pepper and Stengelin a *spastic occlusion of pylorus*, the determining cause; while Kelling suggested that a *simultaneous valvular kinking of the pylorus and cardia* forms the origin of the dilatation. The existence of a pyloric occlusion is disproved however, by the presence of bile in the vomited matter, as well as by the fact that post mortem a nearly constant distention of the duodenum is found, a cardiac occlusion is also disproved by the fact that vomiting occurs in most cases. For the formation of a cardiac valve there is no other clinical support than von Herff's observation aforementioned.

The view that the whole illness depends upon paralysis of the stomach is supported by the analogy we have in the paralyzed intestine in peritonitis. It has besides found much support in a number of experimental results. Among these, most weight has been laid on the following facts. Section of both the pneumogastric nerves in the dog leads as the only factor to a considerable dilatation of the stomach (Carion and Hallion); the animals lose thereby their capability for reflex vomiting, while the direct influence of apomorphin on the vomiting center is still undiminished. The power of vomiting disappears altogether

by division of the spinal cord above the sixth dorsal vertebra (Braun and Seidel). An analogy with some conditions in the acute dilatation of the stomach in mankind is presumed to have been found in the following observation of Kelling and Braun and Seidel. With dogs who have got better after gastrotomy, retching and vomiting prevent dilatation of the stomach as a result of overloading; under narcosis, however, one can distend the dog's stomach to the utmost without vomiting occurring. The fact that the dog upon awaking from the narcosis invariably empties its stomach by vomiting, seems to prove that the result of these experiments cannot be brought to bear on the post-operative dilatation of the stomach in the human being.

Among clinical conditions which have been taken as evidence in favor of the paralysis theory is the appearance of the gastric dilatation in connection with disorders of the spine, illnesses of the nervous system, and severe injuries, but above all its dependence on the paralyzing influence of narcosis. The supporters of the paralysis hypothesis consider the mechanical moments of no importance, and look upon the arterio-mesenteric compression as an accidental find and an unessential result of the pressure of the paralyzed and distended stomach (Braun and Seidel).

The arterio-mesenteric compression was by others taken as an equally plausible explanation of the extraordinary dilatation of the stomach, as any intestinal obstruction makes for the distention of the intestine above it. The oftener the compression under the mesentery was observed, the more attention was paid to it, all the more so since those who at the post-mortem sought for it in most cases found it, pointing to a frequency in occurrence which seemed to exclude the possibility of anything accidental.

Attention has later been drawn by von Haberer<sup>1</sup> and Ekehorn<sup>2</sup> to a chronic dilatation of the stomach and duodenum as a result of mesenteric occlusion at the duodeno-jejunal junction caused by traction on the mesentery from intestinal adhesions. Finally

the mechanical theory won much support by the striking and often more or less instantaneous influence of the abdominal posture.

It was already clear to the first advocates of the mechanical hypothesis that the essential condition for the arterio-mesenteric compression lies in a sufficiently strong pull downward on the mesentery of the small intestine. This traction could be executed by the small intestine lying in the pelvis. To get there the intestine must be empty, and in order to perform the pulling it must have (a fact to which P. Muller first called attention) a fairly long mesentery — long enough to permit the bowel to reach down into the pelvis, but not so long that the bowel may rest on the pelvic floor. Glenard drew attention to the fact that the weight of the empty small intestine was about 500 gr., and by numerous experiments on cadavers, Albrecht, Glenard,<sup>3</sup> Conner and others have shown that such a weight on the mesentery, at any rate in many cases, occasions a considerable arterio-mesenteric compression of the duodenum. Glenard states, on the other hand, that this compression is to a certain extent physiological and is present especially after meals, and that the dragging in the living individual need not be very considerable to bring about the occlusion of the duodenum. There is, however, another question to be answered. Why does the small intestine collapse, and why does it sink down in the pelvis to exercise the primary arterio-mesenteric tightening in Kundrat-Albrecht's meaning? On this point, Albrecht, the theory's chief champion, has no answer. He presumes that earlier there probably has existed an ectasy of the stomach, and it will thus "*durch eine akute Steigerung der Dilatation, eine rasche Füllung des erweiterten Magens, namentlich auch durch eine Aenderung der Lagerung des ganzen Körpers — passive Rückenlage, daher das plotzliche Einsetzen des Ileus nach Narcose und Operation — zu Herabsinken des unteren Teiles des Magens ins Becken kommen,*" he is, as will be seen, tempted to resort to gastric dilatation as the determining factor, but as this is impossible without the theory

<sup>1</sup> Loc. cit. among collected references.

<sup>2</sup> Ekehorn. Fall von enormer Dilatation des Magens und Duodenums von angeborenem arterio-mesenteralem Ursprung. Nord med Arch., 1904.

<sup>3</sup> Glenard. De l'Étéoploose. La Presse méd. belge, 1880, cit. after Conner.



being done away with, his argumentation lacks conviction. Rosenthal sees in the fact that the dilatation often develops so long after the operation that the chloroform or ether have long vanished from the system, an evidence against a primary paralysis due to narcosis, and for the supposition that the mechanical condition must be the primary cause of the gastric dilatation. As arguments to the same end, Landau mentions absence of gastric symptoms before the onset of acute ileus, and the incongruity of the effect of the abdominal posture when the stomach is paralyzed. However, both the arterio-mesenteric compression and the dilatation of the stomach are, as von Haberer remarks, anatomically founded facts, and there are many who doubt as little the existence of a primary duodenal obstruction with secondary gastric distention, as the occurrence of a primary dilatation of the stomach with occlusion of the duodenum as an eventual sequel. Among these, H. Albrecht, Beck, Bloodgood, Conner, von Haberer, Kausch and Weinbrenner may be mentioned.

It is of course impossible to prove that a duodenal occlusion in a single instance cannot be the primary cause of gastric dilatation. But it appears that such a supposition is not very probable. Among other things, an obstruction of the duodenum, with which we now and then meet, does not either anatomically or symptomatically create any parallel to the acute dilatation of the stomach. We are acquainted with many cases of acute duodenal obstruction where, for instance, one or more gall-stones have ulcerated through the gall-bladder into the duodenum and blocked it. In such cases we notice the absence both of gastric ectasy and the clinical picture of the acute dilatation of the stomach. A certain dilatation of the stomach, but only in a slight degree, is on the other hand noticed in many cases, where a chronic cholecystitis has caused a periduodenal inflammation with a successively developed stenosis of the intestine. In neither case do we get the picture of the acute dilatation of the stomach, but that of pyloric stenosis with its relative comfort

after the vomiting.<sup>1</sup> Neither does dilatation of the stomach belong to the regular picture of the high jejunal obstruction. On the whole we are entitled to say that a gastric distention, moderate in comparison with the acute dilatation of the stomach, is usually connected with high intestinal obstruction of long, but not when it is of short, duration. In support of this statement, I mention the following case of high jejunal strangulation which has been treated in our hospital.

A L., female, aged 47, during the last 3 years had suffered from gall stone colic and a ventral hernia. On February 23, 1911, at Diakonhjemmet, cholecystostomy, radical operation of the hernia, and appendectomy were performed.

Feb. 24 — The patient during the first 24 hours was somewhat exhausted, but condition otherwise quite satisfactory. Through the drain, 300 ccm bile escaped.

Feb. 26 — Temp hitherto normal. Yesterday evening thin greenish gastric contents were vomited. With the stomach tube nothing could be evacuated. The condition of the patient, however, is still fairly good. Flatus have been passed this morning.

Feb. 27 — In the last 3 days no bile escaped through the drain. The patient's former comfort during the night has been interrupted by headache and abdominal pain. Slight jaundice.

Feb. 28 — 50 to 100 ccm. bile has again escaped. The patient feels better.

March 1 — Temp 37.4, 37.7, P. 124. The abdomen to the left above the navel, is distended but not tender. The patient has fallen off considerably. With the stomach tube 200 ccm black, thin, fluid is emptied with subjective relief, but the patient sank noticeably and died 1½ hours later.

*Post-mortem.* A horizontal part of the duodenum does not exist, its descending part runs through an opening in the mesocolon to the right of the spine. Through this opening a loop of the topmost part of the jejunum 8 cm long has pushed itself up beside the duodenum and been strangulated there. A slight furrow is visible on both ends of the loop. The strangulated bowel is strongly distended and has compressed both the duodenum and the common duct. The stomach is empty and of normal size or only slightly distended.

Both in obstruction by gall stones and with a high strangulation, as in the foregoing case, the occlusion of the intestine is, however, accompanied by a complicating process, i.e., the perforation of the gall bladder and duodenum, and secondly the strangulation of a jejunal loop. It is reasonable to suppose that

<sup>1</sup> I refer elsewhere to a case of acute duodenal obstruction caused by a gallstone. *Nordhjemmet*. Complicated gallstone cases. *Norsk Magt f. Lægevidensk.* 1912.

the picture of the illness will thereby attain a severer appearance than by a simple compression of the duodenum. The most perfect parallel to this we find in a high jejunal occlusion produced by compressing adhesions, as in the following case.

A F., male, aged 60, sent to Diakonhjemmet December 3, 1909, for chronic dilatation of the stomach. December 7, posterior gastro-jejunostomy was performed on account of a stenosis caused by a duodenal ulcer. After being discharged from the hospital on January 8, 1910, the patient was quite well until March 7, 1910, when vomiting suddenly commenced reappearing after every meal. The patient lost flesh rapidly, and once more entered Diakonhjemmet March 21, 1910. The symptoms of a pyloric stenosis were again recognized. In the early morning the stomach was filled with fermenting material, the evacuation of which with the stomach tube gave immediate relief. Food and drink caused vomiting. The stomach extended downward to the umbilicus. The patient felt weak but preferred, when the stomach had been emptied, to be out of bed.

March 23, laparotomy was performed. A part of the jejunum 7 to 8 cm. below the anastomosis was found adherent to the lower end of the abdominal scar. The transverse colon was riding on the adherent loop, which had a totally obstructing kinking at the site of the adhesion. The stomach was somewhat distended, but less so than at the operation 3½ months ago. By separation of the adhesions the jejunum was freed, and as the gastro-jejunal anastomosis proved to be in order, the abdominal cavity was closed. The patient was discharged April 13, 1910, and has often since, the last time on July 10, 1912, shown himself restored to full vigor.

My observations are thus congruent with Axhausen's in regard to occlusion of the intestine below a gastro-anastomosis, of which he says: "In beiden Fällen war also trotz kompletten hochsitzenden Darmverschlusses nicht ein klinisches Bild entstanden, das dem der sogenannten acuten Magendilatation irgendwie an die Seite gesetzt werden konnte."<sup>1</sup>

Other circumstances seem to witness against a primary intestinal obstruction as a cause of an acute dilatation of the stomach, for instance, both the rapid course of this illness and the quickness with which the dilatation develops. We have no parallel to it either in intestinal obstruction by kinking or compression of any segment of the bowel. In the

majority of the non-treated and fatal cases of my collection, death occurred within two days after the first symptoms of the acute dilatation, and in most of these cases the stomach was found to extend towards the symphysis. In Hanssen-Loberg's operated case the stomach, even after the lapse of 3 to 4 hours, was distended to the lowest part of the abdominal cavity. It would also hardly be reasonable to conclude that the quickly appearing dilatation after overloading of the stomach in people in good health did not date from the overloading's direct influence on the stomach, but occurred as a result of duodenal compression. Borchardt's argument against primary compression — that a stomach which cannot overcome the resistance of a compressed duodenum thereby proves its atony — appears also to me to be of much weight. On the other hand Rosenthal's interpretation of the late appearance of the dilatation as an evidence against a post-operative paralysis due to the narcosis is based on a double misapprehension. He assumes firstly that the acutely distended stomach must be wholly paralyzed, what several observations of gastric peristalsis prove is not the case; secondly, he totally disregards the possibility that incidental causes, independent of time, as we shall see later, can bring the dilatation to develop in an enfeebled or even in a more or less healthy stomach.

The influence of a mechanical factor on the acute dilatation of the stomach is, all the same, difficult to ignore. There is too much at the later stage of the illness which tells of the presence of a real obstruction. The often slight or deficient effect of the treatment with the stomach tube, to which I have formerly called attention, seems for instance difficult to explain, if it were not that the contents of the stomach remaining after each use of the tube were in some way or other prevented from going over into the intestine. The prompt result of the abdominal posture supervening under these circumstances proves that this obstacle is of a mechanical nature. In all superfluity, the hindrance has been seen in a large number of cases. Among such may first be mentioned Kayser's and Kausch's observations of a kink of the first part of the

<sup>1</sup> Axhausen. Zur Frage der sogenannten postoperativen Magendilatation etc. Deutsche med. Wochenschr., 1900, S. 145.

duodenum, and finally the 29 cases mentioned under pathological anatomy, in which an occlusion at the duodeno-jejunal junction is proved by operation or post-mortem.

That a duodenal occlusion, according to Box and Wallace's description, can sometimes be occasioned by the stomach's pressure on the duodenum where it crosses the spine, is certain enough, and with an excessive lordosis, as in Hanssen's Case 7, perfectly clear. Conner has also proved, by investigations on cadavers, that it can sometimes appear with a normal form of the spine, and the lower the duodenum crosses it the easier. But this form of compression seems to be rare, as it has been proved in numerous carefully examined cases that the large stomach exerted absolutely no pressure on the horizontal part of the duodenum.

One must seek the secondary obstruction in the condition which without doubt is oftenest observed, the arterio mesenteric compression. And when acute dilatation of the stomach is first established, all presumed causes, such as an appropriately long mesentery, the small intestine hanging in the pelvis, etc., need scarcely be present in order that the necessary traction on the mesentery can arise. It seems more likely that the heavy and increasing stomach both empties the small intestine and drives it downward and holds it in the pelvis or in the lower part of the abdominal cavity. That a stronger dragging must be exerted on the mesentery in this way than by the mere weight of the small intestine seems probable. This is, of course, only a hypothesis, but it has so much in its favour that it scarcely has met with opposition. And the opinion that the arterio mesenteric compression is a secondary phenomenon, and as a rule called forth by the pressure of the already distended stomach, has by degrees won more and more followers, among whom may be named Bäumlér, Borchardt, Conner, von Herff, Kausch, Laffer, Steida, Thomá and Zade Bull's carefully observed case (my case 4) gains under these circumstances special interest. It is, so far as I know, the first observation of mesenteric compression under circumstances where the true pelvis has been blocked for the small intestine, and where no

other explanation for the compression is present than pressure and dragging from an only slightly distended stomach. The value of the observation is further increased by the fact that it was done in the living subject, and that the result of the treatment supports the supposed importance both of the mesenteric compression and the pressure from the stomach.

If there is reason to suppose that the acute dilatation of the stomach, at any rate in its pure form, is primary, it does not follow that the theory of its origin by paralysis of the gastric nerve apparatus necessarily must be accepted. It must be admitted that a degeneration of the muscular coat of the stomach, as slight in the acute as the chronic dilatation, has hitherto been observed microscopically; but on the other hand the observation of nervous disturbances in the acutely distended stomach appear more as a postulate than a fact. The connection between gastric dilatation and nervous disorder are, in the few known cases of the kind, doubtful enough. The right to transfer the experimental results to the human being are far from indisputable. And finally, we are absolutely without proof of a disease in the nerves of the stomach, first and foremost the pneumogastric, in a case of acute dilatation. The two facts — that a person in good health can be struck as by lightning by this illness; and that under correct treatment regularly, as for instance in my first 5 cases, it is completely cured within a few days — makes it more than difficult to assume that one has had to deal with a nerve disease in the ordinary sense.

There is one factor in the origin of acute dilatation which has certainly been noticed, but has not received such attention as Braun and Seidel give it, this is the effect of food and drink. This seems clear enough where a person in more or less good health simply eats himself to the illness, but it seems likely that the same factor also plays an important part in the case of patients lying in bed. It is thus scarcely accidental that there are among the patients no small number of reconvalescents, or that the illness in post-operative cases oftenest appears about the third day, in other words, at a time when the patient's wish for

food begins to make itself felt. By reading through the history of the cases in my collection I have succeeded in finding, in addition to the 10 more or less healthy subjects who became ill after excessive amounts of food or fluids, 32 cases where the onset of the illness was connected with a meal or ingesta of another kind, oftenest too much drinking with those upon whom laparotomy was performed, H. Albrecht, Albu, Baillet, Baumler, Bloodgood (2 cases), Borchgrevink (3 cases), Braun and Seidel (5 cases), Engstrom (2 cases), Hanssen (No. 7), Ewald Heine, Kayser (2 cases), Kelling, Kirch, Laffler, Lichtenstein, Neck (3 cases), Payer (2 cases), Rosenthal, Stewart, and Thomä. There are thus, among 144 patients, 42 with whom the history includes a hint that ingesta can have been an effective incidental cause. Probably this has oftener been the case; for in post operative cases above all a careful examination of both patient and nurse is often necessary before it is discovered that the prohibition against imprudence in drinking has been most grossly ignored. It was so in Braun and Seidel's first five cases, and in a high degree with my first and second patient. I repeat in shortened form some of the most typical histories from the above mentioned post-operative cases in which error in diet caused the outbreak of the illness. It will be seen that sometimes one overloading of the stomach after the other must occur to provoke the severe picture of dilatation.

On H. Albrecht's 37 year-old patient, amputation of the cervix uteri, colporrhaphia ant. and post., and ovariectomy were performed, April 27, 1906.

Severe post-operative vomiting, much thirst, is supplied with little fluid through the mouth.  
April 28 — Condition good, P 78, T 36.8 Two vomitings.

April 29 — Condition not so good. Feeling of oppression in the epigastrium but no tenderness. Several vomitings, severe thirst. In the evening the patient had succeeded in obtaining plenty to drink, and before midnight the symptoms of dilatation appeared in full vigor.

Baillet's patient was a somewhat nervous 18-year-old boy who had never noticed any irregularities of the stomach. November 7, 1905, exarticulation of the arm on account of sarcoma was performed. The first day all went well, the second day the patient had a good spontaneous action of the bowels and drank "eau de Vals" and a cup of bouillon, the

third day likewise he felt well, was hungry, and asked for food, when he was given a cup of "café au lait." "Quelques instants après avoir pris ce lait, il a un vomissement excessivement abondant sentant très mauvais. À partir de ce moment il ne cesse pas de vomir et de se plaindre d'un douleur au creux épigastrique."

Engstrom's patient No. 1 was a woman 45 years old, of medium health, who had occasionally noticed some weight in the epigastrium after meals. March 28 a supravaginal hysterectomy was performed. During the first two days the patient felt quite well. After a substantial dinner on the third day she felt some distention of the epigastrium. On the morning of the fourth day she felt well and ate a good breakfast and dinner with surprising appetite. Three quarters of an hour later the illness appears. Notwithstanding the emptying of 2 litres of contents of the stomach with the tube, death occurred after less than 24 hours' illness. As the post-mortem shows it is to be attributed to acute dilatation of the stomach accompanied by mesenteric compression of the duodenum.

In Engstrom's Case 2 ovariectomy was performed on a woman 60 years old. During the first two days, complete comfort. The second evening the patient ate with good appetite milk, sandwiches, egg, and some gruel. In the course of the night of the third day some vomiting. On the morning of the fourth day she felt better, ate an egg and drank a little milk. In the morning she drank a bottle of mineral water, whereupon the acute dilatation of the stomach set in.

Upon Rosenthal's patient No. 1, a 37-year-old woman who had hitherto always enjoyed good health abdominal hysteromyomectomy was performed on January 8, 1908. During the first three days all was well, and the function of the bowels was good. At 8 A. M. on the fourth day the patient drank 3/4 litre coffee surreptitiously. As early as 11 A. M. the scene was changed — severe pains in the epigastrium, the face like ashes. P. 100. At 5 P. M., P. 150, violent vomiting and collapse, whereupon a very severe picture of acute dilatation of the stomach developed, which disappeared under treatment by abdominal posture the sixth day after the operation.

But excess in eating and drinking is not always necessary to overfill the stomach. An almost daily experience shows us how retained contents of the stomach, especially after a laparotomy, can be multiplied. This probably occurs partly by decomposition, and therewith accompanying gas development, partly by the irritation of the stagnated contents, which causes hypersecretion. Braun and Seidel express their opinion of the significance of this state of things in the following words: "Narcose und operativer Eingriff bedingen nun zunächst nicht die Dilatation

selbst, sondern nur die motorische Insuffizienz und damit die Disposition zur Dilatation. Damit die motorische Insuffizienz zur Dilatation fuhrt, ist noch eine Ueberfullung des Magens mit flüssigen oder festen Massen bzw. eine Auftreibung mit Gasen wie im Experiment notwendig." It also appears to one that the same authors have found an appropriate expression when they declare the primary cause of acute dilatation of the stomach to be a disproportion between working capacity and the work required. Popularly expressed One can demand too much, even of a stomach, or one may say with Laache "when one thinks of all the injury to which a stomach is exposed in the course of time, one must be more surprised that its wall holds in the majority of cases, than that its muscular coat sometimes gives way."

On the other hand, one is probably on unsafe ground when one concludes that the stomach's failure in working power is provoked by special central or peripheral disturbances of the nervous system of which the stomach becomes the only or special prey. There is nothing which suggests, let alone proves, that the stomach in usual cases of acute gastric dilatation has received more than its share of the whole organism's debilitation in functions. When the stomach, after narcosis or other enervating conditions, is suddenly distended, it seems to conform more reasonably with clinical observations to presume that this occurs, not because the stomach in a special degree is weakened, but because it is an organ of which, under these circumstances, there can often be required too much.

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## CERVICAL DECIDUA

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OUR present conception of the decidua began in July, 1842, when Coste presented a report to the Paris Academy of Sciences entitled "Origine de la Caduque," stating that there was no evidence to confirm the theories of John Hunter and Matthew Baillie concerning the formation of this structure. He held, on the contrary, that the tubal and cervical orifices in the uterine cavity were patent at the time the egg entered the uterus, and claimed that the membrane in question was not an exudate but resulted from a characteristic transformation of the pre-existing uterine mucosa. This work of Coste was followed four years later by reports of a similar tenor by Weber in Germany and Sharpey in England. It was reserved, however, for Robin, in 1848, to first describe the finer histological structure of the decidua and to show that each element had its analogue in the endometrium. The better known work of Hegar and Maier dates from 1863, yet it was not until after the appearance of Friedlander's article in 1870 and the Kundrat and Engelmann reports in 1873 that this doctrine obtained general acceptance.

At the present time the uterine decidua is considered to form only as a result of pregnancy. It is believed to be absolutely essential to all uterine pregnancies, since it has been found in all such early specimens, where it would appear that it formed a nidus for the reception and development of the ovum, and takes part subsequently in the formation of the placenta. The teaching of Heinricius, in 1891, that the membrane was intimately concerned in the nourishment of the ovum during the weeks prior to the establishment of the foetal circulation in the chorion, has received much corroboration from investigators of the same structures in lower animals, most of whom were attracted to it by study of the fate of the glycogen. Others, as Rossi Doria, believe that it also constitutes a barrier to the entrance of

syncytium into the maternal body, while Charrin and Goupil (1905) have advanced the theory that it acts as a lymphatic gland in filtering some of the toxic substances passing toward the fetus.

With our better understanding of the unusual types of pregnancy, there are described many variations in the intensity of the decidual reaction in the uterus. The large thick decidua observed in the non-pregnant side of a double uterus has long been known, as has the similar condition in the uterus with a pregnant and rudimentary horn. Governed largely by such observations, Pozzi and Cazeaux stated that the intensity of the decidual reaction in the uterus was dependent on the proximity of the ovum. This view has not obtained wide acceptance, however, although the hypertrophy of uterine muscle would appear to be so influenced. Varying conditions of uterine decidua are seen in tubal pregnancies. Thus the uterus is seldom the site of marked decidual reaction in early tubal abortion, as it is far more apt to present only in localized areas. Indeed it occurs as a well-developed layer with compact and spongy divisions only in such cases as have passed the second month, at which time the decidua of uterine pregnancy would have nearly reached the height of its development. Moreover, the papillary proliferation in the glands, deemed characteristic of normal pregnancy by Opitz, are absent in the uterine decidua of tubal pregnancy (Werth). Less is known of the uterine reaction in ovarian gestation, while none of the few cases accepted as true instances of abdominal pregnancy present detailed study of the uterine content.

As early as 1891, Bland Sutton had drawn attention to the fact that the decidual reaction in the tube in tubal gestation was not nearly as extensive as has been believed. This view received the support of Futh and Griffiths a few years later, while others, as Kühne, Aschoff, and Kreisch, frankly stated them-

selves as skeptical of the existence of decidua in certain cases of this category, and claimed that cells frequently described as decidua were in reality of foetal origin. Although the nihilistic views of these authors have not obtained much acceptance, certain it is that the decidua reaction at the site of tubal pregnancies may appear only in limited extent. There is, however, always the possibility of a larger and earlier area of reaction which has later become decimated by various degenerations. The presence of decidua in tubal pregnancy has been frequently demonstrated, not only in the pregnant tube but also in its fellow of the opposite side, limited for the most part to the tips of the mucosa. The decidua reflexa, or more properly capsular membrane, in consequence may contain but few or no decidua cells. A definite decidua is lacking in ovarian pregnancies, although the possibility of decidua cell formation must be admitted in the first case of Webster.

The decidua reaction was long supposed to be limited to the uterus and tubes. Gradually, however, other sites were described until we find it recorded:

1. In the mucosa of the uterine body during ectopic pregnancy
2. In the mucosa of uterine adenomyomata during uterine pregnancy
3. In the cervix.
4. On the posterior uterine wall, or in the cul-de-sac beneath the uterine peritoneum
5. In the non-pregnant tube during ectopic pregnancy and in both tubes during uterine pregnancy.
6. In the ovaries and parovarian cysts.
7. In the omentum.
8. In the appendix.
9. In the serosa of the intestine
10. In peritoneal adhesions.

It is of interest to recall that normal pregnancy is not essential for the production of decidua. The structure has been seen with hydatid mole pregnancy and also with chorioepithelioma, although in the latter instance there is always the question whether the decidua was really not preserved from the former pregnancy.

It has long been recognized that the cervix may show decidua change, although the

majority of texts deny the possibility and voice the opinion of Gebhart that the internal os represents the lower limit of decidua formation. For the most part the positive cases quoted below were recorded either in articles devoted to the discussion of the origin of the lower uterine segment or else in consideration of the production of placenta prævia centralis from primary implantation of the egg in the region of the internal os. The majority of these observations are therefore in association with cases of placenta prævia.

Decidua tissue in the cervix was demonstrated by Bayer in the folds of the arbor vitæ in two cases. This observation, recorded in 1885 in an article on "The Physiology and Pathology of the Uterus," excited but little comment, possibly because it did not come to general notice. Nor did the report of Ahlfeld of a similar condition in the upper cervix of a placenta prævia arouse more interest six years later. The majority of case reports credit v. Weiss with being the first to control such observation with specimens, although it is clear that Weiss's report in 1897 is antedated 12 years by Bayer's observations. In Weiss's case the cervical mucosa appears to have furnished at least a part of the decidua serotina, which is surmounted by a firmly attached placenta prævia. Keilmann, five weeks later in the same year, reported a similar condition, although his deductions were based only on clinical findings and were not controlled by specimens.

Von Franque in 1897 presented two cases, one of which was associated with placenta prævia at the tenth month of pregnancy. The specimen was obtained from a VIII-para  $4\frac{1}{2}$  hours after delivery. The placenta was on the anterior uterine wall. Sections from the posterior cervical wall, 3 cm. from the external os, showed many decidua cells, between which were thin walled blood-vessels. The sections taken over an area 2 cm long contained many developed glands containing unchanged high cylindrical epithelium. His second case is of greater interest, as it showed decidua cells in the cervix of a six months' pregnancy with a normally implanted placenta. The space between the decidua of the body and the cervix proper was unchanged



for 3 to 4 mm., below which on the crest of the arbor vitæ were seen areas of typical decidual cells, even as far down as the external os. The cervix appeared very vascular.

Ponfick in 1899 presented two cases associated with cervical placenta prævia. In the first specimen the entire upper portion of the cervical division was filled with placental tissue, which extended down as far as the external os in tongue-shaped processes, closely adherent to the underlying tissue. The second case also presented a cotyledo prævia with a condition in the cervix similar to his other case.

Kronig in 1901 describes the lower uterine segment and cervix of a 19 year-old girl who died in the ninth month of pregnancy from cardiac disease. The child was recovered by Cæsarean section during the death agony. The placenta was normally situated. Some areas of decidual cells were seen in the upper cervix.

Volk in 1903 presented a case of unusual interest. During the examination of a luetic II-para the everted cervix was found to be the seat of several reddish patches of millet-seed size which bled upon slight trauma. A section was taken for diagnosis three weeks before the onset of labor at term. The cervical tissue presented considerable œdema, while the plaques under investigation were found to consist of decidual tissue. Similar areas were seen underneath the healed erosions. In order to ascertain the frequency of decidual reaction in the cervix in placenta prævia, he removed a section from the anterior cervical wall of a woman recently delivered. The gross appearance of this lip suggested the presence of decidua, which was subsequently demonstrated by sections.

Waldstein's case, in 1903, was a twin pregnancy in a VI-para. The placenta was laterally implanted. Post-partum bleeding suggested a torn cervix, and when retractors were applied numerous plaques appeared to view, suggesting a carcinomatous change. Sections taken for diagnosis from the vascular cervix gave a picture of a healed erosion, with large and small nests of decidual cells in the neighborhood of the external os, on the cervi-

cal flaps, and also under the eroded flap of the portio vaginalis.

Hohmeier in 1905 investigated the cervical mucosa in 7 cases in various stages of pregnancy or immediately after birth. Decidua in the lower two thirds of the cervix was seen in 4 cases; twice with placenta prævia and twice with normally situated placenta. The reaction varied in extent, sometimes being broad and extensive while in other specimens it was limited, as in the case of Volk.

Blumberg in 1905 reports a V-para who had been bleeding off and on until her fifth month of pregnancy, when examination disclosed several gray polyps the size of a bean in a large, soft, and somewhat dilated cervix. Three of the polyps were removed for examination and the labor terminated. There was placenta prævia. The polyps were found to be the seat of decidual change. His second case is that of a case which entered the Landau clinic with bleeding from retained secondary post-abortion. The day following their removal severe hæmorrhage indicated inspection of the os. Several granular areas were seen on the cervical lips, some of which were removed and found to be the seat of decidual formation.

Taussig, in his paper before our Society, reported a case of great interest on account of the multiple locations presenting decidual formation. The case was a primipara of 35 years in which a tubal pregnancy was associated with multiple uterine myomata, a cystic adenomyoma, and a parovarian cyst. The pregnancy occurred in the fimbria ovarica, and by the spread of the placenta upon the posterior peritoneum became a case of secondary abdominal pregnancy. Decidua formation was found in the uterus, on the posterior uterine peritoneum, in the non-pregnant tube, in the parovarian cyst, in peritoneal adhesions, and in the cervix. The decidua noted in the cervix presented in the region of the internal os and for 1 cm. below, but could not be demonstrated in the lower cervical canal.

It is more than possible that the case of Seitz does not belong in this list, yet it deserves consideration on account of its many peculiar features. A woman 41 years of age, who had had nine children and two abortions, was

operated in the Munich clinic for carcinoma. Her periods had been irregular for the past two years and there had been bleeding at irregular intervals. On this account the missing of two months' menstruation had not aroused the suspicion of pregnancy, and the enlargement of the uterus had been attributed to metritis. The organ, when removed by vaginal hysterectomy, suggested pregnancy, and was preserved in toto in formalin, after some of the preservative had been injected into the specimen. Before the operation the cervix had been seen to be gaping, yet no membrane was visible in the canal. The lower cervix was considerably torn by bullet forces. On opening the uterus several weeks later a seven weeks' pregnancy was seen, with the chorion embedded on the upper lateral wall. The sac of the foetus contained clear fluid. Between the decidua vera and reflexa was a fresh, unorganized blood clot extending down to the internal os. The cervix presents an early carcinoma. The internal os is nearly as wide as the dilated external orifice, and projecting down throughout the length of the entire cervical canal is a fold of decidua continuous with that of the uterine body, thus extending the circumference of the decidua vera to the external os. Histologically the membrane is identical with that of the uterine body, although it is attached to the cervical tissue more loosely than that in the cavity of the corpus. The membrane is also thinner. The microscopical picture of the underlying tissue is confused, because of poor fixing of tissues and changes incidental to the developing carcinoma. Yet the author concludes that the cervix proper shows no decidual change and that the decidual membrane was forced through the somewhat dilated os by a combination of trauma during the operation and the injection of fixing fluid into the uterine cavity in the preservation of the specimen.

Kermauner in the same year (1906) mentions the presence of cervical decidua in the upper cervix of his specimen of a post-partum uterus which had presented a placenta prævia. Bondi in 1907 describes the uterus of a 37-year-old multipara which was removed in the second month of pregnancy for a carcinoma-

tous polyp. Larger and smaller areas of decidual reaction were found in the region of the external os, some of which were covered with stratified epithelium. Decidual changes could not be demonstrated in the upper cervix.

Stroganoff (1908) records a case of polypoid proliferation on the anterior cervical lip of a three months' pregnancy. This bled freely on contact and was removed for microscopic examination. It proved to be well-developed decidua. The upper layer was here and there covered with stratified epithelium. The patient remained under observation for several months without a return of the growth and without bleeding.

Gaifami (1909) and Ballerini (1910) also describe cases in which they have demonstrated cervical tissue. Excluding the case of Seitz as not proven, and the observations of Gaifami and Ballerini, which are recorded in the Italian journals, and of which I have seen only reviews, we find in the literature 22 reports of decidual change in the cervix in our search. Thirteen of these were observed in connection with placenta prævia, 8 with normally situated placenta, and one in tubal pregnancies. Yet the more recent articles indicate the feeling that the condition is more common than hitherto believed. Indeed Ballerini's article is quoted in review as stating that such reaction occurs in 25 per cent of cases. It is of interest to recall that, of the 8 cases reported in normally implanted placenta, the decidual areas were noted on the lower cervix in 7 instances. On the contrary, in connection with placenta prævia the findings are reversed, since the upper cervix is the usual site. That this portion of the uterus is the site of decidual changes more commonly than hitherto supposed may be inferred from Hohmeier's observations (not mentioned above) that decidua was present in the upper third of the cervix in all of his 7 cases. All cases thus far reported show that the decidual formation occurs only in localized areas without the production of a continuous membrane.

My interest in this subject was recently revived by the observation of an unusual case of pregnancy in which bleeding from the cervix followed trauma and in which a watery, bran-colored leucorrhœal discharge was a

marked symptom. At operation we found numerous small polyps surmounting bleeding areas of the thickened mucosa of a long narrow cervix with everted lips. Although the possibility of decidual growth was discussed, we then feared the tissue would prove to be malignant. The case is as follows:

Mrs. X N., aged 25 years. The family history is negative for tuberculosis and cancer. She has never had scarlet fever, inflammatory rheumatism, nor diphtheria. Had typhoid when 13 years old and was confined to bed by it for eight weeks. A succession of attacks of "sore throat" was relieved by the removal of the tonsils with the guillotine. At 17 she gradually ran down in health while in boarding school. Lost in weight from 105 to 95 pounds. Had a succession of colds in the head, with little or no cough but with fever. The glands near the angle of the right jaw now enlarged to the size of a hen's egg and remained swollen for 5 or 6 months, until removed by operation. The diagnosis of this condition is uncertain although the surgeon stated that there was no evidence of tuberculosis. Two years later there was a slight recurrence and a few discrete glands were removed. Since then (12 years) has been in excellent health until present complaint.

Menstruation began at 15 years. Was regular from the first, of the thirty day type. Never but the slightest pain. Flow lasts 5 days. No leucorrhea.

Married in June, 1912. Last period July 5, 1912. Nausea began early in August. When 3 months pregnant, in this her first pregnancy, a blood stained discharge resulted a few hours after coitus, and was shortly followed by painful uterine contractions. The uterine discharge upon her napkin presented a salmon pink stain of 10 or 12 cm in diameter. It was so watery that it strongly suggested leakage from the sac of the ovum, which suspicion was intensified by the strong odor as of vermin caseosa. The discharge gradually decreased with the subsidence of the pains, although it was still present after 5 days. The pains lasted off and on for 36 hours and disappeared after the use of morphin. The patient remained in bed for 10 days. A few days later, vaginal examination disclosed a 2½ to 3 months pregnant uterus sharply anteverted and with a long narrow cervix as if of an infantile type. The external os pouted slightly but did not admit the finger tip. No evidence of placenta prævia. No blood followed the examination. A speculum was not used.

Shortly after getting out of bed the patient began to complain of leucorrhœa, seemingly aggravated by exercise. Four weeks after the onset of the first attack she was seized with a similar one, save that the discharge was not so profuse and was marked with small fresh blood clots. Uterine contractions continued at frequent intervals and with increasing

pain for several hours, and, feeling that she was about to abort, I sent her to the hospital. Much to our surprise the uterine pains stopped during the night after a dose of morphin, in spite of the fact that she was driven in an automobile some five miles to the hospital. The blood stained discharge lasted 3 days and was again followed by profuse leucorrhœa. Vaginal examination was at this time similar to that of two weeks before, save that the external os felt more gaping. Later, when she was up and about or when riding in her automobile, she became conscious of bloody fluid on several occasions. No pain followed these discharges. The leucorrhœa was profuse and was found to be of a bran color and distinctly watery consistence.

Bleeding again followed coitus on November 22, without subsequent uterine contractions. Feeling that the pregnancy should not be allowed to run without a definite diagnosis of the condition, I suggested dilating the cervix enough to permit the passage of one finger to explore the neighborhood of the internal os. Upon examination in consultation, to justify the risk of abortion during this procedure, there was an immediate and profuse bloody discharge staining the sheets for a foot in circumference with bright red blood. The immediate hemorrhage was comparative in amount to that seen a few hours after delivery. At least four pads, folded into 4 inch width from a yard of sterile gauze, were completely saturated before the patient could be moved to the Presbyterian hospital for immediate delivery.

A few hours later November 26, 1912 the patient was prepared for operation under ether. On exposing the cervix a most unusual condition presented to view. Projecting through the gaping os, and surmounting ridges of a bright red lining membrane, were 12 or 15 worm like polyps moving in the oozing blood which seemed to arise from around their bases. These polyps of varying length (4 mm to 1 cm and 2 to 3 mm in diameter) appeared to crown longitudinal foldings of membrane just as the comb of a rooster is decorated with excrescences. The whole lining membrane of the cervical canal was arranged in longitudinal foldings about 1 cm apart, separated from each other by furrows. The greatest thickness of the folds of the membrane proper was at the margin of the bluish vaginal where it measured 4 or 5 mm. Of the color of angworms, the papillæ were seen of irregular contour distended at the end in an edematous swelling. Blood vessels could be seen in the depths of their substance. In texture the polyps resembled brain substance, breaking off when picked up with forceps. They appeared to cover with their bases at least one fourth of the lining of the canal. The whole picture exclusive of the polyps suggested an extremely injected decidual membrane with the difference that the furrows here ran parallel and vertical, as if they had arisen from the persistence of fetal plica palmaræ.

As the diagnosis was by no means certain, and

fearing the possibility of sarcoma the operative plan was changed from anterior hysterotomy to dilation of the canal and morcellation and removal of the ovum.

The internal os easily admitted the passage of a No 8 Hegar dilator and the vascular cervix was stretched to permit the passage of No 26 which facilitated examination with the eye and finger. The polyps were most abundant as a ring in the lower canal, yet were present for 3 cm above the os. They appeared to decrease in size in the higher levels. The membrane however presented folds to the internal os  $4\frac{1}{2}$  cm above its lower fellow. Indeed the feel above was as of numerous projections extending as papillae down from the maternal side of the fetal sac which but loosely covered the internal os. The lower uterine segment appeared more funnel-shaped than usual as if there had been no widening of the lower pole of an infantile type of uterus. The upper edge of the cervix formed a very obtuse angle with the uterine body.

The placenta was found in the right upper lateral pole of the uterus and the  $4\frac{1}{2}$  month fetus with the membranes was crushed and removed with ovum forceps. No pack was applied but scrapings were taken from the posterior wall of the lower half of the canal for microscopic examination as a guide for subsequent treatment. Twenty four hours later these were found to present no evidence of malignancy.

The sections showed masses of irregular polyps together with considerable free blood. The margins of the polyps were covered with high columnar epithelium the protoplasm of which contained many granules. There were glands with crenated edges, some being full of mucus. There was marked edema of the stroma and the cells were widely separated showing stellate branches with vesicular oval and round shaped nuclei. There were many dilated blood vessels for the most part with thin walled vessels. Many lymphocytes and a few leucocytes were seen scattered through the section. In contrast with the areas just described the tissue presenting decidual change showed an even and rounded edge. The surface epithelium was lower than in the other areas and in certain sections presented the typical flattened surface epithelium of uterine decidua. The cell margins were distinct and the nuclei round. There were comparatively few granules noted in the protoplasm. The stroma was also very edematous and its cells bore no resemblance to the areas first described save that they were also of irregular and stellate shape. The cells presented the typical decidual type (Figs 1 and 2). The nuclei were rounded. Many cells contained two nuclei. There were areas of vesiculation scattered through the sections as if some cells had fallen from the reticulum. There were many lymphocytes in the tissues and the blood-vessels were markedly dilated. In favorable sections it will be seen that the large decidual cells



Fig 1 The tissue on the bottom of the illustration has not undergone the decidual process

are grouped about the blood vessels as if beginning in the perithelial coat (Fig 3).

Five days later under gas the cervix was again inspected when the site of the former excrescences was found to be occupied by an irregular and sloughing base with no evidence of the former picture. The examination of scrapings taken from the lower and upper halves of the cervical canal merely confirmed the clinical picture.

Cervical polyps have long been recognized as a source of bleeding during pregnancy, yet I can find no case on record preventing the picture given in our case. As a rule the polyps are single and of fairly large size.

Three of the cases noted in this review show that bleeding may result from trauma of the decidual patches. Volk's case bled from contact of the numerous plaques, while Stroganoff clearly shows that the bleeding in his case came from the decidual proliferations. Blum-



Fig. 2. Observe the flattening of the epithelium, which is well shown on one margin. The presence of the lymphocytes in the tissue obscures many of the decidual cells.

burg's first case is of interest in that there were several polyps the size of a bean in the lower cervix, yet the marked hemorrhage may well have come from the placenta previa. Yet it would appear that the hemorrhage in his second case (post abortum) arose from abrasions in the decidual area.

The treatment adopted by Stroganoff could not well have been attempted in my case, even had I been aware of his happy result. The denudation of the entire cervical cavity would present too many risks, even though it were proven that the growth was benign.

Thus far no one theory has sufficed to explain the presence of decidual tissue in all its various sites. It is doubtless true that a distinct and continuous membrane is limited to the uterus, yet the ectopic decidua which arises in connection with pregnancy cannot well be distinguished from similar areas of the

compact zone of the decidua vera. And until a better test arises to determine what is and what is not decidua, we must continue to take the cell as our guide, bad guide though it be, provided the diagnosis is controlled by the study of wide enough areas and sufficient sections.

Cervical decidua associated with placenta previa may be extension from above downward, if the histological os grows in size during the formation of the lower uterine segment, as suggested by Bayer, yet a vascular cervix is described in the cases of the literature as a common feature to all. It may be that cervical tissue does not always arise from the stimulus of pregnancy alone, and the irritant of inflammation may commonly be necessary. Certain it is, however, that malignant tumors, circumscribed inflammations, erosions, polyps, etc., are reported most frequently with decidua in this unusual site.



Fig. 3. Decidual cells may be seen on the side of the small blood vessel, apparently arising from the perithelium layer.

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## THE FATE OF BONE GRAFTS

By FRIEDRIC J COTTON, M D, AND HALSEY B LODGE, M D, BOSTON  
From the Laboratory of Surgical Pathology Harvard Medical School

THE present active interest in bone and joint operations of the plastic sort makes urgent an exact knowledge of the processes of repair of bone and cartilage and especially an accurate knowledge of the ultimate fate of fragments of bone when transplanted or otherwise deprived of their normal nutrition

Much work, both clinical and experimental,

has already been done along these lines. Clinical work has given some results that show great promise for the future, but clinical work alone, even with adequate experience, can never give the necessary data as to what happens to transplants, or to bone or cartilage deprived of direct vascular nutrition. Successful clinical cases can never give a conclusive answer as to the manner of repair, or



Fig. 1. Cross-section of a graft and surrounding bone, showing a transplant at 18 days. The straight line indicates the site across the graft is the site where the operation was done in. Both the bone above and below the line, but not the graft inside the operation site.

more than an indication of the limitations which must be faced.

Experimental work in the past has not given sufficient fundamental knowledge to explain satisfactorily the clinical successes and the failures, or to guide future work.

Many statements of belief have been made with a dogmatic definiteness that savors of finality, but they have been accompanied by no sufficient demonstration; there has resulted a controversy, increased perhaps by a lack of uniformity in terms, which leaves the subject in an exceedingly confused state. The arguments as to the fate of bone grafts divide workers into two well defined groups.

At one extreme are those who believe that the bone graft is retained without essential change in the bone transplanted and that it is in itself an active center of centrifugal growth, so to speak, those who believe in other words that the graft loses nothing and has all its inherent powers of growth undisturbed. At the other extreme stand those who believe the transplanted bone is ultimately replaced by newly formed bone, that the graft is merely a scaffolding taking no active part in repair, and is replaced by the reparative power of tissues entirely outside itself.

We believe that we are in a position to prove that neither of these views is a correct statement of the facts.

Such difference of opinion can only be settled by a clear demonstration of the details of the reparative processes in bone and the ultimate fate of grafts, by a knowledge of fundamentals only to be acquired by properly conducted and controlled experimentation combined with an accurate study and interpretation of operative specimens and clinical cases.

It is with the belief that our experiments give facts toward the solution of this problem that we make this preliminary report.

We have been working on a series of experimental operations covering in various aspects the question of the fate of transplants of bone and cartilage, and certain other unanswered questions as to bone and cartilage repair. Such work of necessity will show an independent repetition of more or less of the work of others and is more likely to give a clear perspective than to develop absolutely new facts.

As a whole the work is far from complete, the earliest operation having been done about a year ago. However, one series of experimental specimens of free transplants of portions of bone within joints has demonstrated clearly certain broad principles of repair not generally recognized.

Accordingly, this preliminary report is offered with a statement of what we believe already proved as to the fate of transplants of spongy bone when transplantation is performed under adequate technique and is properly studied. There seems no question that the principle here demonstrated is the fundamental process of aseptic repair from endosteum.

Our experimental procedure has been to interchange portions of the femoral condyles, i. e. to remove a portion of one condyle and replace it with a corresponding part of the opposite femur of the same animal. The transplants have not been scale transplants but pieces of bone of considerable size covered with the articular cartilage on one side (Fig. 1). In our early experiments a small steel pin was used for fixation of the graft. No joint fixation has been necessary. Cats and rabbits of varying ages have been used. The animals show little or no impairment of function even immediately after operation.

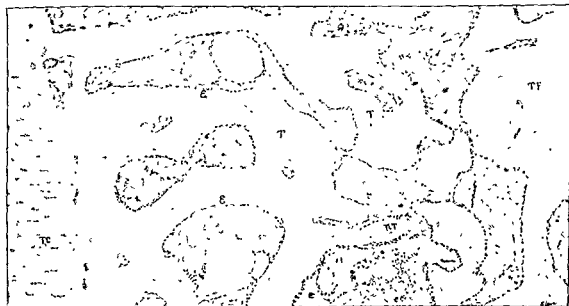


Fig. 2 Section of transplanted bone (rabbit) four weeks after operation. At the right side is seen the bone of the intact part of the femur, all the rest is graft: the articular cartilage shows at the left. Note the almost entire disappearance of bone cells in the trabeculae of the transplant and in the vicinity of the cut edge. Note also the serrated rows of active osteoblasts everywhere. TC base of transplanted articular cartilage. E, endosteal new bone covering transplanted trabeculae. T, trabeculae of transplant—bone cells nearly all degenerated many entirely gone, NT, entirely new trabeculae, TT, trabecula of femur.

Our specimens show a practically uniform survival of the transplant when the technique is adequate, adequate technique comprising real asepsis, fair approximation of the graft to its bed, and reasonable fixation of the graft.

The articular cartilage of the transplant usually shows no gross change in color or texture from that of the surrounding undisturbed joint surface.

In some few instances the cartilage of the transplant has shown a slightly less bluish color than the surrounding articular surfaces, this has not however been the rule.

The fragment very rapidly becomes firmly fixed in place.

Adhesions are absent or at most are few and very delicate, this absence of adhesions is probably due to the constant use of the joint.

Histological preparations obtained at varying intervals show a series of changes in the bony portions of the grafts, the more important of which are constant and very definite.

It is not our intention in this preliminary report to describe in detail the changes of secondary importance or of inconstant ap-

pearance. The essential picture shown is, briefly: (1) the early disappearance of the bone corpuscles in the transplanted trabeculae and in the trabeculae of the host bone for a short distance from the wound surface, (2) without any loss of substance in (or any marked foreign body reaction around) the bone from which the corpuscles have disappeared, this bone is rapidly and completely covered by a layer of new endosteal bone, which unites with endosteal new bone of the host, (3) the new bone is laid down by the activity of end-osteoblasts in all portions of the grafts, center as well as periphery. It has not yet been proved that some of the end-osteoblasts which are active in the graft may not have originated from the endosteum of the host, and extended or even "migrated" from it to the graft, but no one after study of our sections can doubt that in part at least these osteoblasts represent the actively proliferating covering membranes of the transplanted trabeculae, (4) practically no changes, either of degeneration or proliferation in the transplanted articular cartilage, at least up to four weeks.



# DEPARTMENT OF TECHNIQUE

## THE SPINAL COLUMN AS AFFECTED BY TRACTION AND HYPEREXTENSION—A RADIOGRAPHIC STUDY

By NATHANILL ALLISON, M D, AND ARCHIE O'REILLY, M D, SAINT LOUIS

FOR the purpose of removing the pressure upon the diseased vertebral body caused by superimposed weight, and in order to transfer this stress to the posterior parts of the spinal structure, it has been the custom in the treatment of Pott's disease to employ such force as is needed to produce a separation of the vertebral bodies. This has been accomplished by either pulling the spine out by vertical traction or by bending the spine so as to gain a curve with its convexity forward. Clinically, it is universally

recognized that by this separation of vertebral bodies, secured by plaster of Paris jackets or braces, the tendency to deformity is lessened and the integrity of the vertebral body and intervertebral disk is preserved.

It is the purpose of the observations herein described to attempt to determine the actual effect produced upon the spinal column, in so far as the relationship of the bodies of the vertebrae to each other is concerned, by the ordinary clinical methods used in the application of plaster of Paris jackets

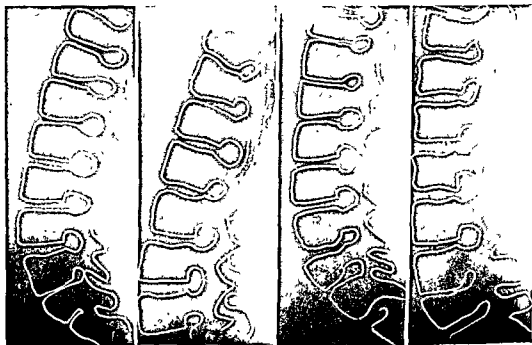


Fig. 1. Normal spine. (a) Erect standing only, (b) vertical traction applied (c) hyperextension applied (d) hyperextension and vertical traction applied

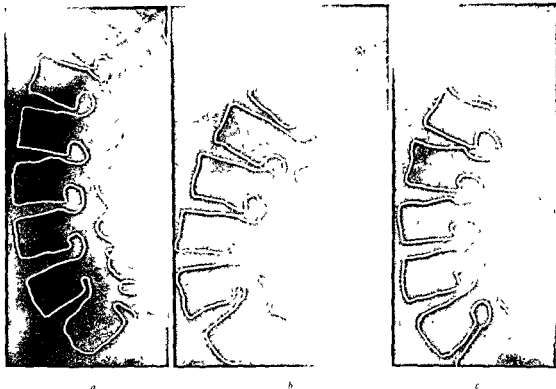


Fig. 2. Dorsal Pott's disease. (a) vertical traction applied, (b) hyperextension applied, (c) hyperextension and vertical traction applied.

It was early recognized that reliable, readable radiograms could not be secured when taken through plaster of Paris jackets, and it was discovered that fenestrated jackets, where the windows cut were large enough to allow a lateral view of the spinal column, presented too great an alteration in the condition, which should be as nearly uniform and stable as possible and which should represent the spinal column as held by a properly applied jacket. The necessity of securing in each series of radiograms a precise lateral view of the spinal column — that is, one in which the axis of Rontgen light was approximately at right angles to the mid-sagittal plane of the spinal column — was calculated upon, and a device was made which supplied the various positions of the spine obtained in the application of jackets and at the same time held the individual under examination in a fixed relationship to both the Rontgen tube and the sensitive photographic plate.

This device consisted of a gaspipe frame standing vertically, from the top of which a rod extended forward, which carried the vertical traction pulleys and head sling. Two adjustable

shoulder girdle supports also ran forward, to secure the shoulders by axillary loops. An adjustable pelvic belt also extended forward from the frame and there was a sliding screw pressure plate which could be placed against any region of the spine, by which any desired amount of hyperextending force could be secured. The Rontgen tube was then placed at a known and recorded distance from the individual's side and the sensitive photographic plate was fixed against the opposite side. These conditions were kept as constant as possible, in order to secure radiograms for comparative study. The following series of radiograms were taken.

1. Normal spine in childhood.
  - (a) Vertical traction applied
  - (b) Hyperextension applied
  - (c) Hyperextension and vertical traction applied

For the above set of views three children, aged respectively five, seven and nine years, were used. The spinal columns in these cases were normal.

2. Pott's disease, dorsal:
  - (a) Vertical traction applied
  - (b) Hyperextension applied

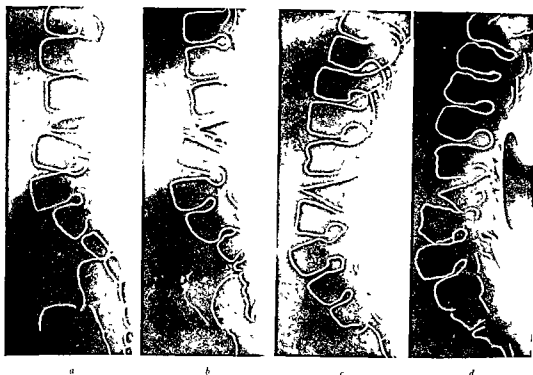


Fig. 3. Lumbar Pott's disease. (a) Erect standing only (b) vertical traction applied (c) hyperextension applied, (d) hyperextension and vertical traction applied

(c) Hyperextension and vertical traction applied

For this set of views two cases of dorsal Pott's disease were selected, aged respectively five and seven years. The disease in these cases had reached a stage of well-marked deformity, but in neither of them were there active symptoms.

### 3. Pott's disease, lumbar

(a) Erect standing only  
(b) Vertical traction applied  
(c) Hyperextension applied  
(d) Hyperextension and vertical traction applied

For this set of views two cases of Pott's disease at or near the dorso-lumbar junction were selected, aged seven and eleven years respectively. In each case there was well-marked deformity and the patient presented no symptoms of acute process.

The series of radiographs obtained were of such a character that reproduction of many of them was not possible, though the vertebral bodies were visible in the plates, the varying densities of the structures made photographic reproductions unintelligible. It was, however, possible in studying the plates in series to see the effect

produced upon the spinal column by vertical traction, by hyperextension, and by a combination of these two forces. It was found that vertical traction alone produced a considerable separation of the vertebral bodies, both in health and in disease, also that by vertical traction the spinal column was straightened as a whole—that is, the posterior dorsal curve and the anterior lumbar curve were considerably reduced. By hyperextension alone a wide separation of the vertebral bodies was secured in the region to which the hyperextension was applied, but there was a corresponding compensatory increase in the other curves of the spine. By hyperextension and vertical traction a wide separation of the vertebral bodies was secured without so great an increase in the compensatory curves as where hyperextension alone was used, and a lessened kyphosis, with a separation of diseased bodies at the region of the disease.

It may be concluded that vertical traction, associated with hyperextension, gives the best resultant position to vertebral bodies that can be obtained by the use of apparatus for securing correction in the treatment of Pott's disease.

## SILVER IODIDE EMULSION—A NEW MEDIUM FOR SKIAGRAPHY OF THE URINARY TRACT

By HOWARD A. KELLY, M. D. AND ROBERT M. LEWIS, M. D. BALTIMORE

OF the many preparations recommended for use in the urinary tract for X ray purposes, none can be said to be without disadvantages. Collargol is probably the most widely used and may be taken as a good example of the group. The chief objections to collargol are three in number:

1. It is a dirty drug, which stains everything with which it comes in contact.

2. The expense of collargol is considerable if one is doing any amount of urinary radiographic work. A well-known urologist lately injected as much as twelve dollars' worth of the substance in attempting to get a radiogram of a diverticulum of the bladder. Even with this amount his result was not satisfactory.

3. Collargol is a proprietary preparation; consequently one does not really know what is being injected into the bladder, ureter, or renal pelvis. This we consider an important argument against its use, given a satisfactory substitute.

Reports of harmful results following collargol injection have come from various sources. In two cases operated upon by Kelly in the last few months, which were previously injected with collargol (by an assistant), it was noticed that the perirenal tissues were stained a greenish black, the collargol having passed through the pelvis although the latter was intact. In neither case was an excessive amount of the solution injected, nor was it run in rapidly. In the first case it was feared that the pelvis had been ruptured, this was not the case, however, in either instance. One of these cases required prolonged drainage before healing.

To be suitable for use in the urinary tract as a skiagraphic medium a liquid must have at least three properties. It must be sufficiently obstructive to the X-ray to cast a good shadow when used in small amounts, it must be non-toxic, and non irritant.

None of the bismuth preparations are satisfactory. The soluble salts are toxic and so cannot be used. The insoluble salts settle rapidly from the best suspension, and so are not of service. The various simple solutions of silver salts are very irritating.

The use of an emulsion of the iodide of silver for skiagraphic purposes was suggested to us by the fact that it has already been success-

fully used therapeutically in the urethra and bladder.<sup>1</sup>

The iodide of silver is insoluble in water and it is therefore necessary to suspend it. This Siter found was best accomplished in mucilage of quince seed. If the emulsion is well and carefully prepared the salt will be held up for a considerable length of time. It should be noted that the quality of the preparation made up by different firms varies a great deal. A suspension of inferior quality should not be used. A suspension of extra fine particles can be obtained by the addition of an excess of potassium iodide to the silver solution and reprecipitation by the addition of water. This we have found unnecessary and undesirable.

The advantages of our preparation over others are: Its cleanliness; it does not stain. The exact strength used is known and can be controlled. On the other hand, the concentration of the proprietary preparations is unknown, and according to Siter varies to a considerable degree. The emulsion of silver iodide possesses anti-epileptic properties. It is also bland and entirely non-irritant. The cost of the preparation is inconsiderable, amounting as a rule to one dollar a pint, as compared with the cost of collargol, which is over five dollars for the same quantity.

As an objection to the use of any emulsion in the ureters and renal pelvis it has been urged that the salt would be likely to settle, to remain in the pelvis or ureter and form a nidus for future calculi. With this in mind we have carefully investigated cases after injections of silver iodide, and have come to the conclusion that this objection is more theoretical than real. This point will be brought out under the descriptions of the illustrations.

The plates described were both made of ureters injected with 5 per cent emulsion of silver iodide. This concentration we find to be sufficient for any ordinary work. It casts a decidedly better shadow than does collargol of equal strength. The shadow is fully as dense as that made by a 10 per cent collargol solution. These facts were determined by taking radiograms of test tubes containing the solutions mentioned. A less concentrated preparation may be employed if a

<sup>1</sup> The Use of Iodide of Silver in Urethrits, " by E. H. Siter, M. D. and A. A. Uhle, M. D. Univ. of Penn. Med. Bull. May 1905.

cavity of any size is to be injected. For example, a 1 per cent emulsion may be used to advantage in the X-ray work on a large hydronephrotic ureter and pelvis or in the bladder. In skiagraphy of the latter we find a sterile suspension of bismuth subnitrate in water satisfactory and inexpensive.

Fig 1. A calculus is shown lodged in the left ureter low down in the pelvis. A catheter was introduced past the stone up to the pelvis of the kidney and 175 cc. of clear urine withdrawn in a

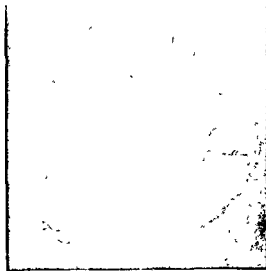


Fig 1

few minutes, 16 cc. of a 5 per cent silver iodide emulsion were then slowly injected. This caused no pain during injection or subsequently. A local plate of the kidney shows the opaque solution in the pelvis, which is not distended. The illustration is a reproduction of a plate taken of the lower ureter, showing very clearly its distended condition above the stone. None of the injection has as yet found its way downward past the obstruction into the bladder.

Before withdrawing the catheter the injection was given several minutes to run out. A few cubic centimeters of sterile water were used to wash away the remaining particles. Two days later cystoscopic examination showed a small amount of silver iodide clinging to the ureteral

orifice. Another X-ray examination of the ureter and kidney at this time failed to demonstrate the presence of the least amount of any opaque substance above the stone, although the plates were unusually good.

During the operation for the removal of the calculus, five days after the X-ray examination, the ureter was opened and its mucosa inspected, but no particle of silver iodide could be demonstrated.

Fig 2 shows the pelvis of what proved to be a normal kidney injected with 8 cc. of 5 per cent silver iodide emulsion. Here the shadows of the papillae are remarkably well defined. In this case a second radiogram of the ureter taken a few days after the first, as expected, failed to show any trace of the salt remaining behind.

In view of these cases we conclude that the emulsion is a safe preparation to use for radiography of the entire urinary tract, and that there



Fig 2

is no danger of any precipitate remaining in the ureter and acting as a nidus for future calculus formation.

#### SUMMARY

A 5 per cent silver iodide emulsion may be safely and satisfactorily used to inject the bladder, ureters, and renal pelvis for radiographic work. It casts as dark a shadow as does an equal amount of a 10 per cent collargol solution.

It is antiseptic, non-irritant, clean, and inexpensive. Its concentration can be accurately determined and regulated. It possesses the great advantage of not being a proprietary preparation.

## GALL-STONE ILEUS

WITH A REPORT OF TWO CASES AND TWO METHODS OF OPENING THE INTESTINE

By JAMES SPENCER BROWN, M. D., MONTCLAIR, NEW JERSEY

Surgeon in Chief, Mountainside Hospital

CASES of intestinal obstruction are comparatively rare, and gall-stone ileus seems to be the rarest form of obstruction. Edward could find only 250 cases of gall-stone ileus recorded up to 1910. Bradbury reported one case out of 50,000 patients treated at the Rochester Royal Infirmary. Mayo Robson records only 4 cases out of 80,000 in-patients and several hundred thousand out-patients applying for treatment at the four largest hospitals in Great Britain, or about one gall-stone ileus to every 75,000 other cases. Frank Martin, after "searching investigation among eminent surgeons, could find only 16 cases of gall-stone obstruction in about 540,000 operative cases, or one in about every 33,000. Barnard of the London Hospital reports 8 cases out of 800 cases of intestinal obstruction from all causes. Of these 8, 3 recovered from the operation and 5 died. A recent report from the Johns Hopkins Hospital, combined with the Union Protestant Infirmary and St. Agnes Hospital, records only one case of gall-stone ileus out of 280 cases of intestinal obstruction.

The records in my own surgical service at the Mountainside Hospital differ somewhat from the above, and show that, while there was one case of intestinal obstruction to every 100 operative abdominal cases, there was an average of only one gall-stone ileus to every 750 other forms of abdominal cases. Or, stated otherwise, intestinal obstruction from gall-stones occurred only one twelfth as frequently as obstruction from other causes.

From the foregoing statement of carefully collected statistics it is evident that even a very busy surgeon will have relatively few opportunities to study gall-stone ileus. Yet, curiously enough, the diagnosis is easily made in most cases. It is true that the symptoms may simulate certain cancerous conditions, but in such cases it is highly probable that the previous history of the case will help to clear up the diagnosis.

Unlike other forms of intestinal obstruction, the onset of an attack of gall-stone ileus is usually gradual, and frequently intermittent in character. That is, the symptoms of intestinal obstruction may terminate suddenly, only to

recur, perhaps several times before operation. But in cases where the occlusion is complete without remission, the clinical picture presented is that of the gradual closure of the lumen of the gut. In these cases the stone is of such shape and so placed that it remains as a stationary plug to the intestine, and the closure is complete from the first. In cases that are intermittent or remittent in character, the shape of the stone is such that, although it forms a complete occluding plug to the intestine when in certain positions, it does not maintain these positions well at first. It may plug the gut completely for a few hours, thus causing the typical symptoms of intestinal obstruction, but these symptoms may abate suddenly as the stone is displaced, only to recur as the stone again falls into an occluding position.

In a recent article on gall-stone ileus the X-ray as a means of diagnosis was mentioned. In cases where there are symptoms of a partial obstruction, if the X-ray findings could be depended upon this method of diagnosis might be of value. But as a rule when the surgeon sees these cases there is no doubt about the method of procedure—they are cases of obstruction due to some mechanical cause, and operation offers the only means of relief. In order to satisfy my own mind about the usefulness of the X-ray findings, however, I made some experiments upon fat women with a good deal of intestinal disturbance. Without preparation I placed upon the abdomen the larger stone shown in the photograph. With one of the best interruptless machine, whether screen was used or not, the detail of the intestinal contents was so pronounced that it is very questionable whether the stone could have been identified had I not known it was there.

The operation in cases of gall-stone ileus, as in other cases of intestinal obstruction, presents little difficulty as a rule. The seat of the obstruction is located easily, either by following down the distended upper intestine to the obstruction point or by following up the lower collapsed portion of the gut. But my experience seems to show that the method of incising the gut may be vital, as illustrated by the two following cases:



Fig. 2



Fig. 1

Enteroliths removed from the two cases reported. Reduced one fifth.

Case 1. Mrs. S. 76 years old. Seen in consultation with Dr. Wallace in 1906. Sixteen years ago this patient had an attack of pain which was diagnosed as gall stone colic. Two years later she had a second attack which was marked by severe epigastric pain, fever, and jaundice lasting about two weeks. There was a sudden subsidence of all symptoms and the patient was restored to health except that from that time until the beginning of the present attack there was always distress a few hours after taking food. This distress was low in the epigastrium to the left of the midline. Forty eight hours before I saw her she was taken with severe epigastric pain with no fever or acceleration of pulse. Her other symptoms were rather indistinct for 24 hours when it was evident that she was developing an intestinal obstruction. At the time of the consultation the obstruction was complete and no gas had been passed for several hours. The abdomen was rigid, distended and painful. Temperature (rectal) 100° pulse 124 and weak.

Operation by midline incision. By following the collapsed intestine a large enterolith was found completely occluding the upper part of the ileum. A longitudinal incision was made and the stone which was a faceted gall stone was delivered. This stone is shown in Fig. 1. On closing the rather generous incision necessary for the removal of the stone it was apparent that there would be left an intestine with a contracted lumen as shown in the drawing. Therefore a rapid excision was performed. The time of this operation was one hour. The patient lived a few hours and died from shock. No post mortem was made.

Case 2. Mrs. M. 63 years old, the wife of a New York physician was seen in June 1912 in consultation with Dr. Irving Meeker and her husband. She was a well-nourished woman with a history of previous attacks of pain simulating gall stone colic. Her present illness began 48 hours previous to my visit with abdominal pain, no rise in temperature for the first 24 hours but with some tenderness over the umbilicus. She slowly developed an intestinal obstruction which was complete at the time of my visit; there had been no passage of gas for several hours. Her abdomen was now distended tympanitic, and rigid with very great general tenderness over the umbilicus. Her temperature was 101° (rectal), pulse 94 and soft.

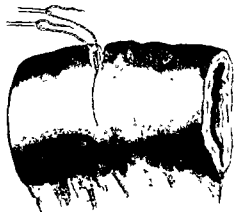
Operation. Midline incision presenting intestine distended the obstruction was found in the ileum which contained a large enterolith (Fig. 2). Profiting by my experience in Case 1, I made a cross-incision and removed

a large faceted gall stone then removing the upper clamp on the intestine, I introduced a Moynihan tube and emptied the intestine of a quart or more of liquid feces. A double Connell or "harness maker's" suture was run in followed by a running Lambert and the abdomen was closed. Time of operation 30 minutes. Her recovery was uneventful.

In my first operation, cited above, the incision in the gut was made longitudinally. Now consider what structures are severed by such an incision. A thin longitudinal external muscular layer is split, a much thicker (and more important) internal muscular layer has its circular fibers severed across, a large number of valvulae conniventes which run at right angles to the line of incision may be severed, and with them the innumerable vessels and lymphatics (lacteals) which are distributed transversely in the intestine. Thus we have the greatest possible destruction of important muscle fibers, vessels, and extensive mucous surfaces. On physiological grounds, then, this method of incision, although the usual one, is wrong.

Observe what happens when the incision is made transversely. A thin and relatively unimportant external muscular layer is cut across, a thick, important circular muscular layer is split and injured only slightly, and perhaps half a dozen or less valvulae conniventes are split and their vessels severed, in contrast to the wholesale destruction of these structures by the longitudinal incision.

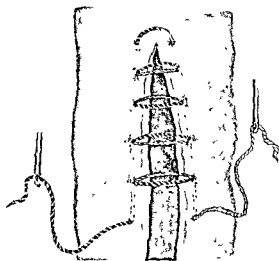
Of course this is of minor importance practically, since the tremendously active collateral circulation in the intestines will take care of any



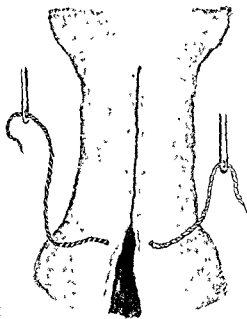
Showing proper transverse incision of intestine

ordinary destruction of tissues. What does concern us vitally, however, is the fact that in closing a longitudinal incision we may close the lumen of the gut, thus producing in effect the very condition we are trying to overcome. When the transverse incision is used there is no possibility of this. The operator may practically disregard the amount of intestinal wall taken up by the sutures, whereas in closing the longitudinal incision he is limited to a scant 3 inches, external measurement, and very much less than this internally.

While it is true that it matters little just which stitch is used in stomach or intestinal work, since the really important thing is always the "man behind the needle" rather than the form of



Double Connell or harness maker's stitch. (One half of the suture is represented as black in the drawing so that the course of each needle may be more easily followed.)



Showing contraction in closing the longitudinal incision.

suture, still it is strange that so useful a stitch as the double Connell, or harness-maker's stitch, should be discarded by so many operators. This stitch offers many advantages over the single Connell. And while it is true that its application is more difficult, nevertheless one may master its technique if one remembers two points: first, all advance is to be made on the mucous membrane side, and, secondly, both needles must be pushed from the peritoneum to the mucous membrane before advance is started.

The single Connell stitch does not include all the blood-vessels, and therefore some bleeding is possible—bleeding that may be severe, while with the double stitch, as shown in the drawing, no bleeding can take place. We have used this stitch now for four years in all our stomach and intestinal work, without a single case of bleeding or leakage, wherefore I am prompted to again call the attention of the profession to its merits.



## A FURTHER CONSIDERATION OF THE USE OF CORPORA LUTEA IN THE TREATMENT OF ARTIFICIAL MENOPAUSE

By CHARLES A. HILL, M. D. PITTSBURGH

Surgeon, Presbyterian Hospital

SINCE the publication of my previous paper,<sup>1</sup> I have received many reports of either partial or complete failures in the treatment of artificial menopause with desiccated corpora lutea along the lines laid down at that time. The results obtained in my own practice were so much at variance with the reports received from some of my fellow-practitioners that I determined to investigate, and report if possible the cause of such failures. As a result of such investigation I found that insufficient medication was the prime factor in the failures to control the symptoms of menopause following the removal of both ovaries in some cases as few as twenty-four 5 grain capsules were administered, while in others the maximum amount given was 100 capsules. If you will stop for a moment and consider just the condition your patient presents at the time of induced menopause—the abrupt precipitation, the patient complaining from the very start of hot flushes, the nervous symptoms manifested, etc.—you will understand why the treatment would of necessity be one of some duration. As many of these patients are young women they present all the symptoms of natural menopause in an aggravated form, for it is well known that the severity of the symptoms are in proportion

to the age of the patient, that is to say, the nearer she is to normal menopause the less will be the discomfort.

The disturbing symptoms usually appear within a short time after the operation, being experienced in many cases at the time the next period should manifest itself, and continue, unless relief is given, for a period of from eighteen months to three years. It has been my experience that the symptoms of menopause may cease for a time after instituting treatment with corpora lutea, and then reappear after its administration has been discontinued.

This fact indicates, in my opinion, that the medication was not continued over a sufficient length of time, and that in each instance it should be continued for several weeks after the patient presents a normal condition. I have found it necessary in most of my cases to give at least 100 capsules, in others 200, before I felt safe in discontinuing treatment.

In cases of relapse, the second course of treatment is usually much shorter than the first, fewer capsules bringing the desired result. In every instance treatment should be instituted as soon after the operation as possible. My procedure has been to administer five grains three times a day, one half to one hour before meals.

<sup>1</sup>The Use of Corpora Lutea in Gynecology, with Report of Cases. Surg. Gynec. & Obst. Dec. 1911.

## REMOVAL OF STRAIN FROM THE ROUND LIGAMENTS WHILE HEALING, AFTER CORRECTING RETROVERSION OF THE UTERUS

By W. F. COUGHLIN, M. D. SAINT LOUIS

Assistant Professor of Surgery, Chief of Clinic, St. Louis University

THAT more operations devised for the cure of a condition, the less likely is any one to be always satisfactory. There are many operations for the cure of retroversion and prolapse of the uterus, and when another variation is made in the procedure we smile.

Alquié thought he had solved the problem in 1841, but it took just forty-one years before anyone else thought as he did, for it was then that Alexander reported his success with the same

method and described the operation which has since borne his name. Since Alexander we have had many others and the end is not yet. The reason is that no single method is satisfactory in all cases. Since the conditions vary, so should the modes of cure.

In October, 1911, while attempting to fix forward a retroverted uterus, I found the round ligaments so small and thin that I feared no lasting benefit would follow the usual procedure.

I took a strand of No. 2 hard chromic catgut, doubled it, and grasped the end in the usual curved forceps. The point of the forceps entered the left external abdominal ring, traversed the inguinal canal, and presented in the subperitoneal space at the left internal abdominal ring. Still in the subperitoneal space, it was made to follow the line of the left round ligament till within two inches of the uterus. The peritoneum over the point of the forceps was now cut and the double catgut strand seized by a second forceps and, being released from the first forceps, was drawn into the abdominal cavity.

The left round ligament was grasped in the usual way and drawn out in the usual manner by the first forceps. The catgut was now picked up on a curved needle where it had come through the peritoneum and the needle passed through the incision into the retroperitoneal space, along the ligament to the left cornu uteri, then through the left broad ligament in the tubo-uterine angle. The two strands of catgut were now carried singly and  $\frac{3}{4}$  of an inch apart across the posterior aspect of the body of the uterus under the serous coat, then together through the tubo-uterine angle of the right broad ligament, then along the right round ligament in the subperitoneal

space to a point two inches from the uterus. A curved forceps now introduced through the external abdominal ring on this side was passed up the inguinal canal and into the subperitoneal space at the right internal abdominal ring and made to follow along the right round ligament to a point two inches from the uterus, where it was brought through the peritoneum and the round ligament and the catgut caught and drawn out by it. Care was taken, as is always done in similar operations, to see that no dimpling of the peritoneum occurred around either ligament as it was drawn through the internal ring. The median wound was closed in the usual way, the ligaments sown to the anterior surfaces of the anterior sheaths of the recti, and then the catgut was tied so as to take all strain off the ligaments. The perineum was repaired. The patient was allowed to lie on back or side as pleased her during convalescence. Union was per primam. The patient left the hospital at the end of three weeks.

Of all the patients I have been able to examine after an operation for retroversion and prolapse of the uterus, the result in this case was the best I have ever seen. The uterus remains higher up and more anteverted than in any of the others, and the patient is well and happy.

## BIRTH BY CONDUPLICATO CORPORE

By N. SPROAT HEANEY, M. D., CHICAGO

WHEN a transverse presentation has so far persisted that the membranes have ruptured and the shoulder has engaged in the pelvis, with the arm prolapsed in the vagina, the chance of the woman delivering spontaneously is very small. If the fetus is not decidedly premature, very soft and compressible, the woman generally dies, undelivered, from rupture of the uterus. The larger the fetus and the smaller the pelvis, the greater the probability of this occurrence. Spontaneous birth by a persistent transverse presentation is an obstetrical rarity.

Birth may be effected by the slipping of the lower body half past the head and shoulders—spontaneous evolution. In such an event there is delivery first of the trunk and breech, then of the legs and last of all of the head. When this evolution occurs in the upper part of the pelvis, the shoulder rises, manifested by the prolapsed arm ascending the vagina in which case the birth

is said to occur by Denman's mechanism. In the event, however, that the shoulder has descended to the vulva, the breech will have to pass the shoulder at the outlet, in which case the arm cannot ascend since the shoulder is fixed. This rarer variation of the mechanism is named after Douglas. Quite a number of births by spontaneous evolution are found in the literature. Payr collected 38 well described cases, among which were 14 children above 2,500 grams in weight, two of these were born alive—one, indeed, weighing 3,270 grams.

Roederer, in the eighteenth century, told of the possibility of spontaneous birth in transverse cases by doubling of the body, and called the mechanism *conduplicato corpore*. In this mechanism the shoulder and arm continue to descend, the body is folded and compressed on itself, the head is pressed into the thorax or abdomen, and birth occurs by expulsion of the pro-

lapsed arm and shoulder, followed by the simultaneous extrusion of the head and trunk, breech and second arm, the feet are born last of all. In birth by spontaneous evolution, the head is born last.

Though this mechanism may occasionally be seen in miscarriages, it is much rarer in births after the period of viability than is spontaneous evolution. Except that the fetus be very soft and premature, unusual conditions must be present that birth may occur. The pelvis must be especially roomy, pains unusually efficient and severe and reinforced by good abdominal muscles, and there must be but little resistance in the soft parts. Consequently, in the reported cases we find that either the mothers have had a number of easy births or have just given birth to a twin. The force of the pains may be judged from the frequency of fractures of the vertebra, the cranium, and the ribs of the fetus. In 1905 Zickmond rightly stated that a careful reading of the cases reported as *conduplicatio corporis* shows that they are, with very few exceptions, cases of spontaneous evolution. Franz, in 1910, after a very careful study, was able to collect only 14 undoubted *conduplicatio* cases. In only three of these cases did the fetus weigh more than 2,500 grams. Aside from the case which I report I have been able to add no other cases to this number. In Dubois' case the weight is not given, though the woman was said to be at term. The patient died at once of sepsis and hemorrhage. In Adelman's case the fetus, which weighed 3,900 grams, had a crushed cranium. Zickmond's case is especially interesting. A VII-para with the following measurements: 27 cm., 30.5 cm., 35 cm., 19 cm. conjugate diagonals 13 cm., gave birth, after a six hour labor, to a freshly dead fetus of from 3,750 to 4,000 grams, without tearing of uterus, cervix, or perineum, and had an uneventful puerperium. The vertebral column of the fetus was broken. The case I have to report is as follows:

Mrs. — Hungarian 29 years old. Mother had twins. Menstrual history normal. Married 10 years, 5 pregnancies before the present one. The first miscarried at fifth month, digital removal of remnants. Four pregnancies followed in quick succession, all full term spontaneous terminations with normal puerperia. Children weighed between 6 and 7½ pounds. First labor lasted 12 hours, the others 3 hours or under. Midwife engaged each time but was never there in time for delivery. Present preg-

nancy. Last menses October 19, 1910 (not sure). Was nauseated most of pregnancy, had frequent headaches and during latter weeks had swollen ankles. Noticed that in latter weeks she was unusually large. First pains at 6 A.M. June 10, 1911. Birth of the first twin spontaneous at 9:30 A.M. Midwife arrived shortly afterwards. Four vaginal examinations by the midwife without any attempt at cleanliness. The interne arrived at 10 A.M. and found uterine contractions of mild severity, an undelivered twin in transverse presentation with pulseless cord hanging from vagina, heart tones not audible. Maternal pulse 120, good and strong. Transport of patient to the Pre-bieterin Hospital where she arrived at 11:30 A.M. Surgical preparation. At this time temperature was 100° F., pulse 120. Presenting at vulva was cord of second twin and placenta and cord of the first twin. Behind the placenta was the left arm of the second fetus protruded into vagina, with shoulder wedged deep into pelvis, back anterior and head on the right side of the mother. Pains violent. While draping her preliminary to contemplated surgical delivery, patient had another unusually violent pain, and a dead boy was expelled from the vagina at 12:15 noon. The protruded arm and shoulder first appeared, then the head impressed into the abdomen of the child, followed by breech and legs. Patient began to bleed profusely, so that the placenta was removed manually from vagina and lower uterine segment and uterine cavity palpated for tears, the cervix was drawn into view, palpated and inspected. No tears were present except slight mucosa tear of the perineal region. Uterus packed and perineal tear repaired. Placenta were separate. Mother's convalescence uneventful, except on afternoon of delivery and on evening of fourth day when there was a sudden rise of short duration to 101° F., the rest of the time temperature never over 99° F. On dismissal (twelfth day) uterus well invaginated and in good position. First child male, weight at birth 5 pounds 9 ounces on dismissal 6 pounds 2½ ounces. Second child, stillborn male, weight 6 pounds, length 49 cm. The head was compressed laterally and the temporal and parietal bone on one side fractured. The mother's measurements taken on dismissal were: 26 cm., 31½ cm., 33 cm., 32+ cm. Promontory not reached.

The factors allowing the birth to occur were: Unusually roomy pelvis, multiparity, no resistance of soft parts because of birth of first twin, strong abdominal muscles, efficient strong pains. The fetus was of medium size, had but recently died, and was consequently not pliable enough to pass with the skull undiminished in size.

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# TRANSACTIONS OF SOCIETIES

## CHICAGO GYNECOLOGICAL SOCIETY

REGULAR MEETING HELD DECEMBER 20, 1912

DR. ARTHUR H. CURTIS. Dr. Watkins and I desire to report some specimens obtained at operation during the last few weeks. The first is a vaginal dermoid the size of a small orange which developed in the vaginal mucosa and protruded into the vaginal cavity in half of its extent. The tumor was located about 2 cm. to the left of the cervix. It was ulcerated and necrotic and contained sebaceous matter and considerable hair. The fact that there was no connection with the presacral or ischio-rectal spaces indicates that the tumor originated in the vagina and did not descend from either of these regions. Vaginal dermoids are of such rarity that but few have been recorded in the literature.

Three cases of tubal pregnancy are of interest because they occurred within such a short interval of time. One is microscopically worthy of your consideration because of its unusual richness in large syncytial cells.

A fifth and last case gave a history and findings negative in all respects except for pelvic pain and the presence of a moderately firm mass to the left of the uterus in the region of the tube. At operation large numbers of adhesions were found about the left tube and ovary. Enclosed in the adhesions and lying adjacent to the ovary was a recently formed clot of blood the size of a large hen's egg. At first glance it seemed that we had to do with a ruptured tubal pregnancy. Later examination, however, showed the tube to be absolutely normal. The ovary contained a large ruptured corpus luteum, the raw surface of which was in contact with the mass of blood. Sections through this region, which you may now observe under the microscope, demonstrate that this hæmorrhage is of corpus luteum origin. Cases of hæmorrhage from ruptured corpora lutea have been reported by Ries and others, their presence, however, is rarely diagnosed, despite the fact that they probably occur not infrequently.

DR. FRANK LYNCH read a paper entitled "Cervical Decidua Associated with Polypus,

Causing Bleeding During Pregnancy." (See p 694)

### DISCUSSION

DR. J. CLARENCE WEBSTER: The occurrence of decidual reaction is an interesting topic for discussion. There can be no doubt that, normally, in the human female, it is a characteristic of the mucosa of the body of the uterus. That it may occasionally be found elsewhere in the Mullerian tract, viz., in the mucosa of the Fallopian tubes and of the cervix, is now well established. Dr. Lynch's case is an example of the latter formation.

Several years ago, while working at the anatomy of the uterus in pregnancy, I found that just as at the region of the os internum there was a gradual transition in the character of the glands of the mucosa, so there was in that of the connective tissue. In several cases decidual changes were found below the level of the os internum. It is not surprising, therefore, that polypoidal elevation of the cervical mucosa should also sometimes present these changes. The transverse sections exhibited by Dr. Lynch remind one of those found in cases of decidual transformation in the folds of the tubal mucosa. The connective tissue appears somewhat œdematous, the cells are enlarged, and the epithelium on the surface is altered from a columnar to a cubical or lower type.

As regards the development of decidual tissue outside the Mullerian tract, there must be much difference of opinion. In the ovary it is easy to explain on the hypothesis that detached portions of the tract may become embedded in the organ and may undergo the genetic reaction. It is possible that other tissues near the tubes and uterus may occasionally contain detached bits of Mullerian tissue.

I am not at all convinced that large cells occasionally described in the omentum and other structures are decidual. The flattened cells lining the peritoneum may under irritation multiply below the surface and form groups of large cells resembling decidual connective tissue cells.

There is no proof that pregnancy can cause a true genetic reaction in the connective tissue of the omentum or any other non-Müllerian tissue.

Dr SCHMAUCH: Dr Lynch's case is that of a young woman pregnant for the first time, suffering from repeated hemorrhage leading to abortion. Looking for the cause, the doctor found quite large polypous proliferations of the cervix, suggesting malignancy. The cervix is the usual place for such polypi to start. Besides, the microscope revealed a decidual change of the structures of these growths.

Dr Lynch seems to be inclined to connect these findings with the miscarriage. However, as the ovum occupies that part of the uterus above the internal os, we would be more justified in assuming changes in the corpus uteri, or still better, some deficiency in the maternal organism, as the cause of the abortion. Even a cancer of the cervix or vaginal portion or a cervical fibroid are not sufficient to prevent normal pregnancy.

One of the few progressive facts that gynecology has produced in late years is Hirschmann and Adler's report of a constant periodical change in the uterine mucosa. These findings I value personally much more highly than all the operations devised during the past ten years for retroflexion and prolapse combined. Still, the profession has been slow to draw conclusions from these findings.

What I consider most important is the histological proof of a four weeks' periodicity in woman's life, consequently we have to change our views regarding menstruation. It is not the mere change in the histological structure of the uterine mucosa that brings on menstrual flow, causes bloody discharges from the uterus, it is rather a chemical change in the whole body of the woman. In order to bleed, woman's blood must undergo certain changes. If the blood did not lose its coagulability, the small lesions of the uterine mucosa would be insufficient to keep up the flow and the blood would coagulate before it left the uterus.

I do not desire to go into detail, but in my opinion this young woman lost her fetus because her organism was not yet fit to stand the constant drain of mineral salts necessary to the building up of a child. This agrees with Dr Lynch's finding of an abnormally anteverted uterus. The small polypi and their decidual change I regard as mere accidentals.

We all agree that decidual changes in the cervix are rare.

Carl Ruge always pronounced the decidual

cell as not typical of pregnancy, he knew the pictures of a menstrual decidua, and dysmenorrhoeic membrane. The decidual cell is not a specific cell, as, for instance, the nerve or epithelial cell. It is the small stroma cell of the mucosa, of a connective tissue, that becomes enlarged and develops into the decidual cell. This name means nothing more than a transient condition of a cell similar to fatty degeneration, e. g. physiological and pathological changes.

Winter and also Webster want this trade-mark decidual cell reserved for the stroma cell of the uterine mucosa. Any other cell, connective tissue or mucosa cell, that undergoes the same changes and looks the same is not a decidual cell, but a decidua-like cell. This question of a name is hard to dispute, however, it assumes a different aspect if we ask ourselves, what leads to this temporary change in the cells. Everyone says it is the child, at least in pregnancy, an explanation for the decidual change in menstruation has not as yet been tried.

The influence of the growing child always had something mysterious for the gynecologist. Serial sections were made by the thousand, new stains were tried, but nothing was found. The plausible explanation given was that the decidual change facilitates the embedding and nourishment of the growing ovum. Not satisfied with these views, the theory of a poisoning of the maternal organism by the child was advanced, I do not know by whom, but it soon became common property. From the vomiting to the pigmentation and to eclampsia, everything was explained by toxæmia through the fetus. This absurdity has kept gynecology and obstetrics at a complete standstill for the past ten years.

If a farmer puts his wheat in the ground, it takes away some fertility from the soil necessary to build up the wheat plant. Since he has no chance to make serial sections he does not talk about poisoning, but comes to the conclusion that the wheat robs his soil of certain elements. If you transmit this simple explanation to the pregnant woman, pregnancy and woman's life would be more easily understood. There is not much biological difference between the growing wheat and the growing ovum, both are robbing their soil, but not poisoning. The most important element in making up human and plant organisms is the lime. This same lime is what makes the nucleus of our cells so easy to stain with hematoxylin, because it contains calcium proteids. This same lime has to pass through the syncytium, so easy to stain, in order

to get to the foetus. On account of the greater vitality of the foetal organism, the latter takes its mineral elements wherever it can get them. The law of propagation is so severe that even the woman with cancer or tuberculosis can give life to a strong child. Her own organism suffers, succumbs to the disease, but the child thrives. The foetus gets its supply of lime and other elements at first from the maternal blood, later on it will draw on the lime deposited in all the tissues. Lime is one of the main factors that enables blood to coagulate. If the loss of lime in the blood cannot be made up sufficiently, the woman is liable to bleed during pregnancy. Quite a number of young women lose their foetus through constant hæmorrhage. Prolonged rest in bed and time, on the other hand, have helped to save the ovum in some desperate cases.

Now to come back to the decidual cells. Their main characteristic besides their size is the fact that their nucleus does not stain well, in direct opposition to the high affinity of the normal stroma cells to stain. Again, where do we find decidual cells? Dr. Lynch mentioned all of the places. They are always situated around blood and lymph vessels, in the pelvis, on all the roads that carry nourishment to the foetus. This is the reason why Waldeyer proclaimed the perivascular origin of the decidual cell. In the same manner as we sometimes find the epithelial layer of the uterine glands undergo syncytial changes through chemical changes, the same influence of altered nourishment is liable to transform any connective tissue cell, not even muscle cells excepted, into decidual cells. But all these phenomena are not the result of a poisoning, they are in my opinion to be regarded as a temporary robbing or enriching in the original elements making up nucleus and protoplasm.

DR. WALTER C. JONES. The conclusion of Dr. Schmauch in regard to the fallacy of the theory of toxæmia of pregnancy may be correct. However, I object emphatically to the method of his reasoning by comparing the development of a foetus in utero to the growth of a plant in the soil. In the first place, reasoning by analogy is fallacious. Secondly, he chose a very unfortunate subject for comparison, as far as establishing his point is concerned. For according to modern agricultural research, the theory has become pretty thoroughly established that plants in the process of their growth deposit toxins in the soil, so that after a few years any given plant has thus made the soil more or less inimical to its further growth. By counteracting these toxins the same plant may be made to grow on indefinitely in a

soil which was originally suitable. This idea is not a mere hypothesis, but is a well-established theory based on abundant actual experimental evidence which has been produced at numerous state and federal agricultural experimental stations, and among scientific agriculturists this theory has almost displaced the old one that plants in the process of their growth abstract from the earth certain elements necessary for their growth and thus impoverish the soil. Hence it seems evident that if the doctor wishes to convince others that the theory of toxæmia of pregnancy is incorrect, he will not be able to do so through reasoning by analogy, especially if he selects such an unfortunate subject for comparison. I would suggest, on the other hand, that he present experimental and clinical evidence.

DR. WALTER C. JONES, by invitation, read a paper entitled, "Inversion of the Uterus, with a Report of a Case Occurring During the Puerperium and Caused by a Fibroid" (See p. 632.)

#### DISCUSSION

DR. DORLAND. I have had some experience in uterine inversion. It was my privilege to encounter what I believe to be one of the most remarkable obstetric cases ever experienced in Philadelphia. The patient was an elderly primipara, 34 years of age. The presentation was the first position of the chin. I expected to have an easy delivery, but after full dilatation of the os no descent occurred. Under ether I attempted to perform a cephalic version, but failed. Podalic version was then attempted but was found impossible. Craniotomy was performed through the eye, but the head failed to collapse. Finally, by combined traction from below and pressure from above a very large foetal monstrosity was delivered, the uterus immediately following it in a condition of complete inversion. I stripped off the placenta, immediately re-inverted the fundus, and packed the cavity of the uterus with sterile gauze. An active hæmorrhage was taking place from a vestibular tear above the urethra. The bleeding joint was ligated and the tear sutured. Notwithstanding the prolonged labor with much digital exploration, attempts at version, the performance of craniotomy, inversion of the uterus, replacement of the fundus, and repair of a vestibular laceration, the puerperium was absolutely apyretic and recovery complete. The monstrosity was a case of iniencephalus or retroflexion of the foetus, a very rare form of teratism, with solid union of the skull and spine as far as the lumbar region. Subsequently I assisted

Dr. Baer in an operation upon the wife of a farmer at Trappe, Pennsylvania, for the removal of a large sloughing uterine fibroid polyp which closely simulated uterine carcinoma in all its clinical manifestations. In the removal of this large polyp, which was about the size of a six months' fetus, and which was attached to the uterine fundus, a partial inversion of the uterus occurred. This was replaced by a gauze-wrapped instrument without injury or further complications.

Dr. HERBERT M. STOWE: I have observed three instances of acute inversion of the uterus following delivery.

The first case was one in which the inversion occurred when the attending physician attempted to deliver the placenta by traction on the cord. There had been some bleeding in the third stage, and placental delivery was tried as a hemostatic measure. One hour later, I found the uterus inverted and lying in the vagina. The placenta had been peeled off the uterine wall with resulting free bleeding. The woman was in shock, pulse 140, weak and threatening. There was no free bleeding at this time. Absence of the fundus in its normal position was easily demonstrated. The parts were cleansed and covered with boric acid compresses and morphin administered. The following morning, some 18 hours later, an attempt to replace the organ was successful and the woman recovered promptly.

The second instance was evidently due to a violent effort to expel the placenta by the Credé method. Inversion was complete. There was little bleeding but the shock was marked. The placenta was partially detached before the accident occurred, and it was easily removed afterward. I saw this patient some two hours later, after several fruitless attempts to replace had been tried. An expectant treatment was recommended until the symptoms of shock had subsided, and the organ was replaced without much difficulty on the second trial.

The last inversion took place 14 days post-partum, and was due to straining at stool. The case is very similar to that reported by Ferré (*L'Obstétrique*, March, 1905) where the inversion occurred 6 days post-partum from the same cause. This patient collapsed at once and had to be carried back to her bed. The fundus did not appear at the vulva, but the cup was plainly felt by abdominal palpation. Symptoms of shock disappeared within 12 hours, and the uterus was replaced under ether anesthesia. The patient recovered.

In all these cases the utero-vaginal tract was

tamponed with lysol gauze to prevent a recurrence of the accident.

During the stage of acute inversion, which is rarely fatal per se, I prefer to wait. If the patient appears to be bleeding to death a circular compression may be used. It is not advisable to operate during shock. The secondary shock may be sufficient to turn the scale against the patient. An analysis of 184 cases collected from the English literature supports this expectant treatment. The total mortality was 43, or 23.4 per cent. Of 79 cases in which the uterus was replaced in the presence of shock, 24, or over 30 per cent, died. In 23 cases in which shock did not exist, no deaths resulted. In 17 cases death occurred before the arrival of the physician, and was generally due to shock. In 45 cases in which the reposition was delayed until the condition was more or less chronic, reposition was effected without mortality.

The prompt recognition of a paresis of the placental site should make the physician cautious in delivering the placenta, for if this portion is drawn into the contraction ring, any muscular action will cause it to be inverted or reinverted according as it has or has not passed this point.

Dr. FRANK W. LANCHE: Like the last speaker I have also had two cases of inversion of the uterus, both of which were seen in consultation. The first was in the service of a midwife, who claimed that she had made no traction upon the cord, but that the uterus inverted shortly after the birth of the child, after a fit of coughing. She had removed the placenta before the arrival of the physician whom she had summoned to her assistance. I found surprisingly little bleeding but considerable shock. The uterus was replaced without difficulty by pressure immediately inside the cervix, and shortly after the correction of the deformity I was much surprised to find it balloon considerably above the navel, so that I was afraid to leave it without packing, although I hesitated on account of the danger of interfering with drainage in a case which threatened infection. I must also say I feared that reinversion would occur following removal of the gauze. Ergot was given in the hope of combating the shock, as well as with a view of obtaining uterine contractions.

The second case undoubtedly followed vigorous expression of the placenta in the hands of an able-bodied physician. He acknowledged that pressure had been made when the fundus was not firm, and that suddenly the uterus seemed to disappear from his fingers. This patient lost considerable blood and went into profound and

immediate shock. The inversion in this case was not as complete as the other, and like it was easily reduced by taxis. No packing was used, nor did it appear necessary, as the case presented no subsequent complication. I neglected to state that the placenta, part of which was not separated, was removed during the efforts at replacement.

DR. RUDOLPH W. HOLMES: The subject of inversion of the uterus is one which has interested me for years, since I had my first patient with this rare complication. The existence of a fundal fibroid of a polypoid character causing an inversion is of more interest in its gynecologic aspect than in its obstetric relation. So far as I can recall in my investigations preparatory to writing my paper on inversion of the uterus, no instance of inversion due to fibroid occurred in immediate relation to the puerperium, so this case of Dr. Jones stands out as an unique one. There can be no question, however, that, granted the existence of a fundal polyp, the gynecologic inversion would be more likely to occur in relation to the puerperium than later, for the large softened uterus with a relaxed cervix would predispose to the descent of the fibroid, which would drag the fundus with it.

In times past it had aroused much discussion why a primipara was peculiarly prone to inversion, this stands out clearly when we realize that primiparous labors bear a relation to multiparous ones as one to three or four, in my statistics, of 333 cases 68 per cent occurred after first labors. My own impression is that the explanation lies in a faulty innervation or maldevelopment of the uterine musculature, or both. Contributory to this is the rather constant presence of the fundal placental site.

I believe all will bear me out that shock is rarely seen after obstetric operations, as my memory goes now I can hardly recall a fully developed instance of shock after delivery. On the other hand, shock is one of the most frequent, and in general the most characteristic, symptoms of the presence of inversion. This is in rather sharp contrast to the surprisingly slight hemorrhages which may accompany the trouble. This is explained by the fact that contractions of the third stage are absent, therefore the placenta is firmly adherent to its site, on the other hand, the great pull on the ovarian vessels and disturbance, at least, of the uterine vessels minimize this danger.

We cannot lay down any hard and fast rules as to whether the placenta should be removed before or after reposition, in the main, I believe removal

after reposition is more desirable and safer, for it prevents the exposure of the placental site in great measure to contamination. Secondly, the removal of the placenta may irritate the uterus to contraction, which may seriously compromise the return. On the other hand, the placenta attached may prevent the ready return of the uterus, from the mere bulk of the mass.

In the days of the late Nicholas Senn we heard much of the *furor operativus* which held too many surgeons. The numerous operative procedures outlined by Dr. Jones, and they are but a very few of the many methods of operative correction, incline me to believe that most of the operations suggested are brought forward to exploit the wonderful ingenuity of the originator rather than any particular call for their need. Painstaking conscientious attempts at taxis will secure a return in by far the majority of cases. You may recall that many years ago the late Dr. White of London had a case where taxis failed, the next morning amputation was to be done, but during the night spontaneous reposition took place. This has occurred not so rarely, and possibly may be explained on the hypothesis of a reversal of the vicious contractions. Not so long ago I had a woman who had gone between two and three weeks in her puerperium, with a recognized inversion. Under anesthesia taxis seemed futile, even though continued for a protracted period; just as the announcement was made that it was useless to continue, the fundus snapped back into its normal position. It is axiomatic that the knife should never be used until repeated attempts at manual revision have failed.

There are two facts that must be borne in mind in manual reposition: one, that that part which came down last, i. e. the cervico-uterine wall, must be returned first; by this procedure two layers of uterine wall are passed through the cervical canal while if the fundus is attempted first you have four layers. Secondly, it is well to direct the force of the pressure to either ilio-sacral fossa, thereby escaping the hindrance of the promontory.

To recapitulate: Immediate reposition; brisk bimanual massage (the internal hand being within the uterine cavity), when contractions are secured, then manual removal of the placenta, and then Cr  d   of the hand and placenta—never withdraw the hand with the contained placenta without Cr  d  ; then immediate utero-vaginal tamponade. This last, to prevent recurrence, is so essential that I would wish this society could put itself on record that, from this day forth, anyone who reposed an inverted uterus and did not use the tamponade was culpable.



## COLLEGE OF SURGEONS

REPORT OF MEETING FOR ORGANIZATION HELD IN WASHINGTON, MAY 5, 1913

**A**N American College of Surgeons was organized at a meeting in Washington on Monday evening, May 5, 1913. Four hundred and fifty prominent surgeons of the continent of North America came together at the invitation of an Organization Committee which was appointed by the Clinical Congress of Surgeons of North America at its meeting in November, 1912. This committee consisted of Edward Martin of Philadelphia, Emmet Rixford of San Francisco, John B. Murphy of Chicago, Rudolph Matas of New Orleans, Albert J. Ochsner of Chicago, Charles H. Mayo of Rochester, Minn., Frederic J. Cotton of Boston, George Emerson Brewer of New York City, J. M. T. Finney of Baltimore, W. W. Chipman of Montreal, George W. Crile of Cleveland and Franklin H. Martin of Chicago.

The invitations, which resulted in this large gathering of surgeons in Washington, were extended by the Organization Committee after a carefully prepared campaign in which each large university city on the continent was visited by a member of the committee who met, in person, a group of selected men brought together by a committee of three in each locality, which committee had been authorized by the Organization Committee to extend an invitation to the surgeons in their locality to meet the representative of the Organization Committee. These five hundred men who were invited to the meeting in Washington, four hundred and fifty of whom responded, represented all branches of surgery and surgical specialties. The surgeons responding to the invitation were designated as the Founders of the College.

## FOUNDERS' MEETING

At this meeting in Washington, called for the purpose of effecting an organization, the Committee on Organization presented a definite tentative plan, which plan included a call of the meeting, the presentation of by-laws, the presentation of resolutions, and a plan for the completion of the organization by the election of governing bodies and executive officers.

## CALL OF THE MEETING

The men were called together by Edward Martin, Chairman of the Organization Committee, who asked for the reading of the Call

The Call of the Meeting was read by Franklin H. Martin, Secretary of the Committee. This call, which is herein quoted in part, summarizes the work for which the Committee was authorized:

"First, It should formulate a minimum standard of requirements which should be possessed by any authorized graduate in medicine who is allowed to perform, independently, surgical operations in general surgery or any of its specialties.

"Second, It should consider the desirability of listing the names of those men who desire to practice surgery and who come under the authorized requirements.

"Third, It should seek the means of legalizing under national, colonial, state or provincial laws, a distinct degree supplementing the medical degree, which shall be conferred upon physicians possessing the requirements recognized by this law as necessary to be possessed by operating surgeons.

"Fourth, It should seek co-operation with the medical schools of the continent which have the right to confer the degree of M. D., under the present recognized standards, and urge these colleges to confer a supplementary degree on each of its graduates who have, in addition to their medical course, fulfilled the necessary apprenticeship in surgical hospitals, operative laboratories, and actual operative surgery.

"Fifth, It should authorize and popularize the use of this title by men upon whom it is conferred, and its use should especially be urged in all directories of physicians in order that the laity as well as medical men can distinguish between the men who have been authorized to practice surgery and those who have not.

"The net result of the Committee's efforts is that five hundred surgeons of all specialties, representing every large center of population, every important university city with a teaching faculty of medicine, every special and general society representing a specialty of surgery, all the important surgical clinics and hospitals, besides many independent surgeons from all portions of the North American continent, have consented to become founders of the organization under contemplation, and of this five hundred fully four hundred and fifty are here at this hour ready to fulfill their obligation."

The Founders' Organization was then com-

pleted by the election of Edward Martin as Chairman and Franklin H. Martin as Secretary, and the authorization of an order of business

#### BY-LAWS

The interest in the by-laws centered in: (1) The Name, (2) The Object, (3) The Formation of the Organization, (4) Its Administrative Plans, (5) The Meaning of the Fellowships, (6) Fees, (7) Directory, (8) Expulsion, (9) Standing Committees.

**I. NAME.** The name of the corporation is the College of Surgeons

**II. OBJECT.** The object of the College shall be to elevate the standard of surgery, to provide a method of granting fellowships in the organization and to formulate a plan which will indicate to the public and the profession that the surgeon possessing such a fellowship is especially qualified to practice surgery as a specialty

**III. ORGANIZATION.** The corporation is to be known as the College. The College shall consist of all members of the corporation, to be known as Fellows, and shall vest the general management of the corporation in a Board of Governors, and the Board of Governors shall in turn vest the details of the management in a board of trustees, to be known as the Board of Regents

**IV. ADMINISTRATIVE PLANS.** The Board of Governors shall consist of the five hundred surgeons invited by the Organization Committee to serve as founders of the College and who have signified their willingness to act in that capacity. The members of the first Board of Governors shall also be known as the founders of the College of Surgeons

This original Board of Governors shall be divided into three classes to serve one, two and three years. At the annual meeting in 1914 and at each succeeding annual meeting, the Fellows of the College shall elect fifty surgeons to membership in the Board of Governors, each for a term of three years. Thirty of these are to be elected from a list of nominations consisting of two members each nominated by the following surgical societies and associations of North America:

American Surgical Association, Section on Surgery of the American Medical Association, Section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association, General Surgical Division of the Clinical Congress of Surgeons of North America, Division of Surgical Specialties of the Clinical Congress of Surgeons of North America, American Gynecological Society, Southern Surgical and Gynecological Association, Western Surgical Association, Sec-

tion on Surgery of the Canadian Medical Association, American Association of Obstetricians and Gynecologists, American Orthopedic Association, American Association of Genito-Urinary Surgeons, American Laryngological Society, American Ophthalmological Society, American Otological Society.

Twenty members shall be elected at large to represent surgeons of North America not affiliated with the above societies or associations.

The Board of Regents shall consist of twelve surgeons, members of the Board of Governors, elected by the Governors, these to be divided into three classes whose terms of service shall expire in one, two and three years. Their successors shall be elected each for a term of three years. Not more than three of each class of four shall be elected from one country. The Board of Regents is increased to fifteen in number by three officers of the Corporation, the President, Treasurer and General Secretary. The two Vice-Presidents are ex-officio members of the Board. The Board of Regents is the administrative body of the corporation, corresponding to a board of trustees in other corporations

**V. FELLOWSHIPS.** The Fellows of the College shall be graduates in medicine who are legalized to practice medicine in their states and provinces, who have made an application for fellowship, such application to be endorsed by three Fellows of the College, one of whom shall be a member of the Board of Governors, and who meets the qualification requirements that shall, from time to time, be established by the Board of Regents, and who shall be elected to fellowship by the Board of Regents on recommendation of the Committee on Credentials.

Each Fellow of the College shall be designated a Fellow of the College of Surgeons and shall be authorized and encouraged to use the letters F. C. S. after his name on professional cards, in professional directories, and in scientific articles published in surgical literature.

**VI. FEES.** An initial fee of twenty-five dollars shall be required of each member of the College on his election to fellowship by the Board of Regents. The annual dues will be five dollars.

**VII. DIRECTORY.** The Board of Regents shall issue each year a directory containing the names and addresses of the Fellows of the College of Surgeons, arranged by states, provinces and colonies.

**VIII. EXPULSION.** Any member of the College may be expelled for unprofessional or other conduct inconsistent with the rules and regula-

tions of this corporation by a majority vote of the Board of Regents.

**IX. STANDING COMMITTEES.** The Board of Regents shall elect the following standing committees: (1) Credentials, (2) Legislation, (3) Graduate Schools and Hospitals.

These by-laws were unanimously adopted with the provision that the Board of Regents should make any minor corrections deemed desirable and present such corrections for adoption at the next meeting of the Board of Governors.

#### OFFICERS ELECTED

President, J. M. T. Finney, Maryland, First Vice-President, W. W. Chipman, Quebec, Second Vice-President, Rudolph Matas, Louisiana, Treasurer, A. J. Ochsner, Illinois, General Secretary, Franklin H. Martin, Illinois.

#### BOARD OF REGENTS

J. M. T. Finney, Maryland, A. J. Ochsner, Illinois, Franklin H. Martin, Illinois, George I. Brewer, New York, George E. Armstrong, Quebec, John B. Murphy, Illinois, Edward Martin, Pennsylvania, F. J. Cotton, Massachusetts, Herbert A. Bruce, Ontario, C. I. Stokes, Washington, D. C., William D. Haggard, Tennessee, George W. Crile, Ohio, Robert E. McKechnie, British Columbia, Charles H. Mayo, Minnesota, Harry M. Sherman, California.

#### SELECTION OF FELLOWS

Much interest was manifested in the method to be pursued in the selection of the members of the corporation and in the method of conferring fellowships. A series of resolutions covering this subject was offered by the Secretary and adopted.

The prospective Fellows are to be divided into four classes, A, B, C, and D. Classes A, B, and C are by resolution to be admitted without the formality of submitting to an examination under the following resolution:

**RESOLVED**, That the A class shall consist of the founders of the College.

"The B class shall consist of the members of the special surgical societies constituting the Congress of American Physicians and Surgeons, and one hundred each, nominated by accredited committees, from the Section on Surgery of the American Medical Association, from the section on Obstetrics, Gynecology and Abdominal Surgery of the American Medical Association, from the General Surgical Section of the Clinical Congress

of Surgeons of North America, from the Division of Surgical Specialties of the Clinical Congress of Surgeons of North America, from the American Association of Obstetricians and Gynecologists, from the Surgical Section of the Canadian Medical Association, from the Southern Surgical and Gynecological Association and from the Western Surgical Association.

"The C class shall consist of surgeons of prominence of five years in the practice of surgery or a surgical specialty and who, in the opinion of the Committee on Credentials, are eligible for fellowship in the College without formal examination."

For all others, coming under class D, the following resolution was passed:

**"BE IT FURTHER RESOLVED**, That the Board of Regents, through the Committee on Credentials, limit the admission of Fellows to classes A, B, and C until the Board of Regents formulates a standard of requirements for class D and reports the recommendations back to the Board of Governors for approval at the meeting to be called by the Board of Regents in Chicago, November, 1913."

It will be the spirit of this association to open the fellowship to all competitors in surgery without favor. Scientific attainments, surgical ability, unquestioned moral character, measured by the College's standards, shall constitute the measure for fellowship.

There are many hundreds of surgeons on the continent, who are not included in classes A and B, who fall into the C class. Applications from these men will be welcome and their names will have the most careful consideration by the Committee on Credentials.

All applications for membership should be forwarded to the Secretary of the corporation. It would add to the ease of the work of the Committee on Credentials if references in the way of vouchers or recommendations from one or more well-known surgeons accompany each application for fellowship.

#### FORMAL CONFERRING OF FELLOWSHIP

The first convocation for the formal conferring of fellowships will occur in November, 1913, at a time and place that will be designated later. The first directory of Fellows will be distributed at that meeting. For that reason the applications for fellowships by men in A, B, and C classes should be filed as promptly as possible in order to facilitate the correcting of lists for publication.

## ON MEMBERSHIP IN THE COLLEGE OF SURGEONS

BY FRANKLIN H. MARTIN, M. D., GENERAL SECRETARY

Since the organization meeting of the College of Surgeons of America, many inquiries have been received as to the method of procedure required to attain fellowship in this organization.

To the fifteen surgeons comprising the Board of Regents, representing territorially all sections of the North American continent, has been intrusted the delicate task of formulating a membership plan, to include the reception of applications for membership and the final election to fellowship in the College of those fulfilling the standard of requirements. The founders of the College conferred upon the Board of Regents almost unlimited freedom of action in carrying out this preliminary work.

While it is true that three classes of surgeons were declared eligible to election to fellowship in the College immediately—the resolutions dealing with each of these classes provided that each individual thus named shall be confirmed by the Regents before he can be formally declared a Fellow of the College.

These three groups include the surgeons and men practicing surgical specialties who have been in the practice of their specialty for a considerable length of time and who are recognized as surgeons of established reputation. They are divided for convenience into three classes. Class A, men who were chosen to organize the College by the Committee on Foundation. Class B, surgeons who are members of one of the fifteen national organizations of surgeons and surgical specialties which are designated as constituent societies. Class C, surgeons of prominence not included in Class A and not affiliated with any of the societies represented in Class B.

For Class D, which will include all other candidates, namely, young men recently graduated in medicine who wish to practice surgery as a specialty, and men who have been in the practice of medicine for a longer period and are desirous of developing a surgical specialty, a special com-

mittee of the Board of Regents is carefully preparing a standard of requirements for admission, and this plan will be presented for the approval of the Governors at the November meeting.

Of the A, B, C and D classes of members, the first three classes will be subject to consideration during the next six months, and while the men in these classes have been declared eligible to immediate membership, the Board of Regents has taken measures to subject these names to the same careful scrutiny that will be employed in the selection of members from Class D.

No man will come before the Board of Regents for final election to fellowship until the applicant has made a formal statement in writing that he is desirous of becoming a member, such application to be accompanied by the membership fee.

Surgeons representing Classes A, B, and C will receive notice that they are eligible under the by-laws, and on request will be sent blanks upon which they can make their applications.

Surgeons who come under Class D, and in this class is included all legalized practitioners who are desirous of becoming members, will be furnished blanks by the Secretary upon which they may make their applications, which in due time will be carefully considered by the Board of Regents.

It is the desire of the present Board of Regents to establish the precedent that any applicant for fellowship in the College will receive the fullest consideration.

Finally, when a surgeon's original application has been passed upon favorably by the Committee on Credentials, he will be sent a fellowship blank upon which he may make his declaration of acceptance of the principles of the College, together with such other data and information as the Regents may require as a matter of record. The applicant will then be duly elected by the Board of Regents a Fellow of the College of Surgeons of America.



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# Clinical Congress of Surgeons of North America

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FOURTH ANNUAL SESSION

CHICAGO

NOVEMBER 10 TO 15, 1913



# CLINICAL CONGRESS OF SURGEONS OF NORTH AMERICA

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## CHICAGO AS A MEDICAL AND SURGICAL CENTER

### II. MEDICAL SOCIETIES OF CHICAGO AND THE IMPRESS OF MEDICAL MEN UPON THEIR TIMES

By ARTHUR R. REYNOLDS, M. D., CHICAGO

ORGANIZATIONS for mutual benefit of those engaged in the same pursuit is general in this age and needs no argument in its defense. It is obvious that men who are massed and acting as a unit in any given direction are more effective than when acting singly.

It is fair to say that medical organization in Chicago has not only kept pace with the spirit of the times: it is far ahead of many other occupations, is excelled by few if by any other industry and is certainly far ahead of any other profession.

When Chicago was young there was little tendency toward organization and the effort to arrange medical men for mass action has had its struggle. It has passed through the vicissitudes of infancy. It has had its stage of boyhood pranks and follies but has emerged at last into its full grown manhood and is now in the sturdy stride of its greatest vigor.

According to a foot-note in "Early Medical Chicago," by the late James Nevins Hyde, A. M., M. D., published in 1879, the date of organization of the Chicago Medical Society is given as 1836 but no other data can be found in corroboration. That there was some move at this time toward organization may be readily believed, for in the autumn of 1836 an act was drawn by Chicago physicians for the establishment of Rush Medical College. It is not likely that such steps would be taken without consultation of the leading physicians of the town, especially as many able and public-spirited physicians were in active practice. There were such energetic men as Drs. Harmon, Brainard, Goodhue, Boone, Egan, Dyer, Kimberly, Brinkerhoff and others busily engaged in organizing a Board of Health and other public affairs. Furthermore, the citizens were preparing for the incorporation of the city, which took place

in the following year. However, no permanent record can now be found and the date of organization of the Chicago Medical Society must be 1850 and from this time we now have a continuous record. The records show that the Society had its periods of alternating activity and somnolence in the earlier years, but on the whole kept pace with the spirit of the times and to-day has a resident membership of 2,427 and 100 non-resident members. The society is divided into fourteen branches scattered throughout the city and suburbs, each of which meets monthly. Ten other societies on the specialties—Neurology, Pathology, Urology, Dermatology, Laryngology and Otology, Pediatrics, Orthopedics, Surgery, Gynecology and Ophthalmology—are in affiliation with the main society. The special societies meet monthly and each has a flourishing membership. The main society meets weekly but in common with all medical societies in Chicago it does not meet during the summer vacation season. It has eighteen standing committees. A perusal of their titles will give an idea of the diversified character of the work covered by them. The standing committees are upon Public Relations, Ethical Relations, Membership, Criminal Abortion, Medico-Legal Questions, Milk Commission, Organization, Contract Practice, Compulsory Industrial Insurance, Abuse of Medical Charities, Entertainment, Program, Criminal Punishment, Patent Nostrums, Standardization of Hospitals, Election Commission, Medical Education, and Constitution and By-Laws. All business of the society is transacted by a Board of Counselors consisting of fifty members. Fifteen are elected by the society at large and the balance by the branch societies proportionate to their membership.

The Physicians Club was organized in 1895 out of two clubs having the same purpose that had existed for several years previous. The purpose of the club as stated in the constitution is "to promote good fellowship among its members, to encourage high ethical standards, to advance the interests of the Medical Profession, and to discuss at stated meetings, topics of current interest relating in any way to medical affairs." There is a membership of 300 and meetings are held once a month, dinner is served and discussion on some selected subject is had afterward. The Physicians Club more nearly than any other organization is the forum upon which medicine meets the public. The ablest speakers and specialists both within and without medicine in the country have sat at their board and entertained the membership upon diverse sub-

jects in which medicine is in some way interested.

The Medico-Legal Society of Chicago was organized in 1886 largely by the efforts of Dr. E. J. Doering. The object of the society as stated in the constitution "shall be the investigation, study and advancement of the science of medical jurisprudence, the punishment of unprofessional and criminal practices by members of the medical and legal professions, the prevention of blackmailing and the procuring of such legislation as may be necessary to secure the ends above enumerated." There are 80 members composed of lawyers and doctors. They hold monthly meetings and in the earlier years were active in preventing unjust prosecutions of medical men. Since other agencies have taken that field the Medico-Legal Society has retired. This society stands in a unique position in one especial way. The funds of the society have been so well invested that each member has had returned to him all the money he has ever paid in as dues or initiation fees and there is still a balance of several thousand dollars in the treasury. The present membership pay no dues and soon will expect a dividend from interest accumulated.

There is a Medical Woman's Club of Chicago which meets monthly. There is a Society of Medical History doing excellent work.

There is the Association of the Medical Reserve Corps, 200 strong, in Chicago, and a Medical Golf Association 100 strong.

There are two Homœopathic Societies in Chicago, each with a membership of 150.

There is a Homœopathic Woman's Club of 100 members, called the After Dinner Club, which meets monthly.

As it can be taken for granted that men cannot assemble together in any legitimate cause without good resulting, so it may be granted that great good cannot fail to come from the meetings of the hosts of medical societies. The stimulus and information is important to the members. It is also important to the public. The public is now very largely taking its information on medical topics directly from the medical profession. Less and less does the public turn to the almanac or the cure-all advertisement in the newspaper or magazine for medical information. Less and less do the public prints cater to swindling medical advertisements and some newspapers do not give them any space whatever, while some of the leading magazines have borne the brunt of the battle that has exposed the ridiculous and harmful practices of medical advertisers.

All of these blessings can be traced to medical

organization and the impress of medical knowledge and the medical way of looking at things, upon the people.

It is even claimed that the medical habit of seeking basic facts, the habit of weighing evidence or symptoms and the necessity for cautious speech gives the well-trained medical man an equipment that enables him to take up work in other fields or in other professions or even in business readily, while the ever present necessity of his being politic enables him to grasp the intricacies of politics more easily than those of any other pursuit except the law.

Medicine is inseparably connected with the early history of Chicago, for Fort Dearborn was named for Major-General Dearborn, who, according to the late Dr. John B. Hamilton, was a practicing physician before he took military service. Dr. Daniel Brainard was editor of a newspaper soon after coming to Chicago. Dr. Levi D. Boone was elected Mayor of Chicago in 1855. The late Dr. N. S. Davis delivered a series of six lectures in Chicago in 1850 on the Sanitary Conditions of the City and the Means for its Improvement. He pointed out the danger from drinking well water. One hundred dollars was raised by the lectures and was used to start

what has since become Mercy Hospital. It has been said of those lectures that the plans Dr. Davis then suggested for a pure water supply and for its necessary complement—the proper disposal of the sewage of the city—are the basis of all that was done toward these ends during all the subsequent years.

Dr. J. V. Z. Blaney made the first analysis of Lake Michigan water in the winter of 1855-56 and in 1869 taught the necessity of boiling the water as a means of purifying it. At this time Dr. John H. Rauch was Health Officer and Dr. H. A. Johnson was President of the Board of Health. Together they checked the cholera. Dr. Rauch later became an officer of the State Board of Health and commenced his great work of cleaning up medical practice and establishing minimum qualifications for medical education, and Dr. Johnson became an influential member of the National Board of Health.

While congratulating ourselves upon the power that organized medicine of today wields, and not unmindful of the blessings we enjoy, let us not forget the labor and the far-seeing wisdom of the early medical men of Chicago, for it is upon the foundation they bulld that we now rest in security and comfort and that gives promise for the future.

In later issues of this magazine in this department will appear a series of brief sketches of the lives of those surgeons whose work contributed so largely to the importance of Chicago as a clinical surgical center: Edmund Andrews, Daniel Brainerd, Moses Gunn, Reeves Jackson, Bogue, Powell, Lee, Christian Fenger, Ferdinand Henrotin, Nicholas Senn.

An article descriptive of the hospitals of Chicago, with illustrations, will be contributed by Dr. John A. Hornsby, while Dr. Mortimer Frank will write on the medical publications. Other articles will have to do with the medical schools and other factors in Chicago's medical life.

On the following pages appears a preliminary program of the clinics.



WM F. SCOTT — Oak Park Hospital — 10 to 12  
 M L HARRIS — Polyclinic Hospital — 11  
 NORMAN KERR — Polyclinic Hospital — 11  
 ARTHUR DEAN BEVAN — Presbyterian Hospital —  
 11 to 12  
 CARL B. DAVIS — Presbyterian Hospital — 11 to 12  
 C. N. BUSWELL — Ravenswood Hospital — 8 to 10  
 C. H. McKLNN — St. Joseph's Hospital — 10 to 12  
 C. G. BUFORD — St. Joseph's Hospital — 2  
 A. E. HALSTEAD — St. Luke's Hospital — 8 to 11  
 W. H. ALLPORT — St. Luke's Hospital — 2  
 AXEL WERELIUS — South Shore Hospital — 9 to 12  
 D. A. K. STEELE — University Hospital — 1 to 3  
 F. A. BESLEY — Wesley Hospital — 4 to 6  
 PAUL B. MAGNUSON — Wesley Hospital — 9 to 12  
 H. M. RICHTER — Wesley Hospital — 4 to 6  
 C. C. ROGERS — Willard Hospital — 10 to 12

### Friday, November 14th

A. G. ZIMMERMAN — Alexian Brothers Hospital —  
 9 to 11.  
 A. J. OCHSNER — Augustana Hospital — 8 to 1  
 EDWARD M. BROWN — College of P & S — 1 to 3  
 F. A. BESLEY — Cook County Hospital — 10 to 12  
 A. E. HALSTEAD — Cook County Hospital — 10 to 12  
 GEORGE F. THOMPSON — Cook County Hospital —  
 8 to 10  
 SYLVAN KUNZ — German Hospital — 10 to 12  
 GILBERT H. WYNEKOOP — Lake View Hospital — 10  
 to 12.  
 BENJAMIN H. BREAKSTONE — Maimonides Hos-  
 pital — 10 to 12  
 E. WYLLIS ANDREWS — Mercy Hospital — 8 to 10  
 L. A. GREENSFELDER — Michael Reese Hospital —  
 8 to 10  
 L. L. MCARTHUR — Michael Reese Hospital — 9 to 11  
 D. N. LISENDRATH — Michael Reese Hospital — 9 to  
 12  
 EMANUEL FRIEND — Michael Reese Hospital — 9  
 to 12.  
 CARL BECK — North Chicago Hospital — 9 to 11  
 J. R. PENNINGTON — Polyclinic Hospital — 2 to 4  
 CHARLES J. ROWAN — Presbyterian Hospital — 11  
 to 1

G. N. BUSSEY — Ravenswood Hospital — 10 to 12  
 G. W. GREEN — Ravenswood Hospital — 8 to 10  
 CARL WAGNER — St. Joseph's Hospital — 10 to 12  
 M. J. SEIFERT — St. Mary's of Nazareth Hospital —  
 8 to 10

W. E. SCHROEDER — Wesley Hospital — 8 to 10  
 ALLAN B. KANAVEL — Wesley Hospital — 4 to 6  
 PAUL B. MAGNUSON — Wesley Hospital — 9 to 12  
 F. J. CONLEY — West Side Hospital — 10 to 12

### Saturday, November 15th

N. M. PI RCY — Augustana Hospital — 8 to 10  
 I. G. DYAS — College of P and S — 1 to 3  
 JACOB FRANK — Columbus Hospital — 8 to 12  
 C. VOLINI — Columbus Extension Hospital — 9 to 12  
 F. WYLLIS ANDREWS — Cook County Hospital —  
 9 to 12  
 C. E. HUMISTON — Cook County Hospital — 10 to  
 12  
 PAUL F. MORF — Cook County Hospital — 1 to 4  
 A. G. ZIMMERMAN — German Hospital — 9 to 12  
 H. R. CHISLITT — Hahnemann Hospital — 8.30  
 C. E. KAILKE — Hahnemann Hospital — 8.30  
 C. I. WYNN KOOP — Lake View Hospital — 8 to 10  
 H. A. MOJE — Lake View Hospital — 10 to 11  
 BENJAMIN H. BREAKSTONE — Maimonides Hos-  
 pital — 10 to 12  
 J. B. MURPHY — Mercy Hospital — 8.30 to 12  
 CARL BECK — North Chicago Hospital — 9 to 11  
 EMIL G. BECK — North Chicago Hospital — 9 to 11  
 Bismuth work only  
 S. DAHL — Norwegian Deaconess Hospital — 9 to 11  
 PAUL GRONNERUD — Polyclinic Hospital — 2 to 4  
 D. W. GRAHAM — Presbyterian Hospital — 2 to 5  
 W. H. ALLPORT — St. Luke's Hospital — 2  
 AXEL WERELIUS — South Shore Hospital — 9 to 12  
 W. E. SCHROEDER — Wesley Hospital — 10 to 12

### Days and Hours to be Announced

JAMES BERRY — Illinois Steel Co. Hospital  
 WILLIAM HESSERT — Alexian Brothers Hospital  
 ARTHUR B. FUSTACE — Post-Graduate Hospital  
 S. C. PLUMMLER — St. Luke's Hospital

## GYNECOLOGICAL AND OBSTETRICAL CLINICS

COMMITTEE J. CLARENCE WEBSTER Chairman FRANK T.

### Monday, November 10th

CARLY CULBERTSON — Cook County Hospital — 8  
 HENRY BANGA — Polyclinic Hospital — 10  
 THEODORE J. DOEDERLIN — German Hospital — 9  
 FRANK T. ANDREWS — Mercy Hospital — 8 to 10  
 EMIL RIES — Post Graduate Hospital — 9  
 WM. B. FLHRING — Rush Medical College — 11  
 ARTHUR H. CURTIS — Wesley Hospital — 9  
 ROBERT T. GILMORE — Wesley Hospital — 10  
 MARK T. GOLDSTINE — Wesley Hospital — 10.30

### Tuesday, November 11th

JOHN W. BIRK — Lake View Hospital — 2 to 4  
 CHANNING W. BARRETT — Polyclinic Hospital — 10  
 A. B. KEYES — Polyclinic Hospital — 3 to 4  
 ALBERT GOLDSPOHN — Post-Graduate Hospital — 11

ANDREWS, CHARLES S. BACON, and THOMAS J. WATKINS

CAREY CULBERTSON — Rush Medical College — 11  
 W. M. THOMPSON — St. Joseph's Hospital — 9  
 PHILIP S. DOANE — St. Joseph's Hospital — 2.30  
 W. S. BARNES — Wesley Hospital — 3

### Wednesday, November 12th

HENRY F. LEWIS — Cook County Hospital — 3.30  
 LESTER FRANKENTHAL — Michael Reese Hospital —  
 9  
 FRANK W. LYNCH — Presbyterian Hospital — 11 to 1  
 J. CLARENCE WEBSTER — Presbyterian Hospital — 11  
 N. SPROAT HEANEY — Rush Medical College — 11  
 E. C. DUDLEY — St. Luke's Hospital — 2  
 MARY G. McEWEN — University Hospital — 9 to  
 11  
 ARTHUR H. CURTIS — Wesley Hospital — 9  
 MARK T. GOLDSTINE — Wesley Hospital — 10.30



*Thursday, November 13th*

CAREY CULBERTSON — Cook County Hospital — 8  
 A. B. KEYS — Cook County Hospital — 3 to 4  
 JOHN W. BIRK — Lake View Hospital — 2 to 4  
 I RANK T. ANDREWS — Mercy Hospital — 8 to 10  
 C. V. BACHELLE — Polyclinic Hospital — Afternoon  
 HENRY BANGA — Polyclinic Hospital — 10  
 CHANNING W. BARRETT — Polyclinic Hospital — 10  
 WM. B. IEHRING — Rush Medical College — 11  
 PHILIP S. DOANE — St. Joseph's Hospital — 2 to 3  
 W. S. BARNES — Mercy Hospital — 3  
 ROBERT T. GILLMORE — Wesley Hospital — 10  
 THOS. J. WATKINS — Wesley Hospital — 9

*Friday, November 14th*

A. B. KEYS — Polyclinic Hospital — 3 to 4  
 ALBERT GOLDSPOHN — Post-Graduate Hospital — 11  
 CAREY CULBERTSON — Rush Medical College — 11  
 W. M. THOMPSON — St. Joseph's Hospital — 1

*Saturday, November 15th*

LESTER I RANKENTHAL — Michael Reese Hospital — 9  
 FRANK W. LYNCH — Presbyterian Hospital — 11 to 1  
 J. CLARENCE WEBSTER — Presbyterian Hospital — 11

N. SPROAT HEANEY — Rush Medical College  
 THOS. J. WATKINS — Wesley Hospital — 9

*Days and Hours to be Announced*

CHARLES S. BACON.  
 L. S. BAILEY — Hahnemann Hospital  
 HENRY T. BYFORD — West Side Hospital  
 FRANK CARLY  
 PETER S. CLARK  
 JOSEPH B. DELLÉ — Mercy Hospital, Wesley Hospital  
 W. A. NEWMAN DORLAND.  
 DAVIS S. HILLIS — Provident Hospital.  
 J. C. HOAG — St. Luke's Hospital.  
 RUDOLPH W. HOLMEL — Augustana Hospital.  
 GUSTAV KOLISCHER  
 FRANKLIN H. MARTIN.  
 B. A. MCBURNET  
 CHARLES L. PADDOCK — St. Luke's Hospital.  
 CHARLES B. REED — Wesley Hospital.  
 ERNST SAUR NHAUS — West Side Hospital.  
 GEORGE SCHMAUCH  
 L. S. SIMON — Michael Reese Hospital.  
 HERBERT MARION STOWE  
 BERTHA VAN HOESSEN — West Side Hospital.

## GENITO-URINARY SURGICAL CLINICS

COMMITTEE: LOUIS E. SCHMIDT, Chairman, WM. F. BELFIELD, ROBERT H. HERBST, GUSTAV KOLISCHER, VICTOR LESPINASSE

*Monday, November 10th*

GUSTAV KOLISCHER — Michael Reese Hospital — 9 to 11.  
 L. W. BREMERMAN — Office — 4 to 6

*Tuesday, November 11th*

HERMAN L. KRETSCHMER — Alexian Brothers Hospital — 8 to 10  
 B. C. CORBUS — College of P. and S. — 8 to 10  
 HARRY A. KRAUS — German Hospital — 4 to 5  
 L. W. BREMERMAN — Lakeside Hospital — 8  
 ROBERT H. HERBST — Polyclinic Hospital — 4 to 6

*Wednesday, November 12th*

L. E. SCHMIDT — Alexian Brothers Hospital — 9 to 11  
 F. KREISSL — Jefferson Park Hospital — 2 to 3  
 GUSTAV KOLISCHER — Michael Reese Hospital — 9 to 11  
 L. W. BREMERMAN — Office — 4 to 6

*Thursday, November 13th*

L. W. BREMERMAN — Lakeside Hospital — 8  
 ROBERT H. HERBST — Polyclinic Hospital — 4 to 6  
 J. S. NAGEL — West Side Hospital — 3 to 5

*Friday, November 14th*

HERMAN L. KRETSCHMER — Alexian Brothers Hospital — 8 to 10  
 D. N. EISENDRATH AND FRENCH S. CARY — College of P. & S. — 2 to 4  
 HARRY A. KRAUS — German Hospital — 4 to 5  
 F. KREISSL — Jefferson Park Hospital — 2 to 4  
 LOUIS E. SCHMIDT — Michael Reese Hospital — 9 to 11  
 B. C. CORBUS — Post-Graduate Hospital — 3 to 6  
 WM. T. BELFIELD — Presbyterian Hospital — 4  
 L. W. BREMERMAN — Office — 4 to 6

*Saturday, November 15th*

L. W. BREMERMAN — Lakeside Hospital — 8.  
 V. D. LESPINASSE — Wesley Hospital — 3 to 10

## ORAL SURGICAL CLINICS

COMMITTEE: TRUMAN W. BROPHY, Chairman, THOMAS L. GILMER, and WM. H. G. LOGAN

*Days and Hours to be Announced Later*

THOMAS L. GILMER — St. Luke's Hospital and Northwestern University Dental School.  
 ARTHUR D. BLACK — St. Luke's Hospital and Northwestern University Dental School.  
 WM. H. G. LOGAN — Frances Willard Hospital.

TRUMAN W. BROPHY — Presbyterian Hospital and Frances Willard Hospital.  
 HERBERT A. POTTS — Northwestern University Dental School.  
 FREDERICK B. MOOREHEAD — Presbyterian Hospital.

## ORTHOPEDIC CLINICS

COMMITTEE E. W. RYERSON, Chairman, WALLACE BLANCHARD, CHARLES M. JACOBS, JOHN L. PORTER and HENRY B. THOMAS

*Monday, November 10th*

E. W. RYERSON — Children's Memorial Hospital — 3 to 6; Polyclinic Hospital — 1 to 2  
 THOMAS P. LYNAM — Home for Destitute Crippled Children — 2 to 4.

*Tuesday, November 11th*

JOHN L. PORTER — College of P. and S. — 9 to 11, Home for Destitute Crippled Children — 11 to 1  
 WALLACE BLANCHARD — Home for Destitute Crippled Children — 2 to 4

*Wednesday, November 12th*

E. W. RYERSON — Children's Memorial Hospital — 3 to 6, Polyclinic Hospital — 1 to 2  
 P. B. MAGNUSSON — Home for Destitute Crippled Children — 2 to 4.

*Thursday, November 13th*

HENRY B. THOMAS — Cook County Hospital — 11 to 12  
 E. W. RYERSON — Home for Destitute Crippled Children — 2 to 4

*Friday, November 14th*

WALLACE BLANCHARD — Home for Destitute Crippled Children — 2 to 4  
 E. W. RYERSON — Polyclinic Hospital — 1 to 3

*Saturday, November 15th*

C. M. JACOBS — Home for Destitute Crippled Children — 2 to 4

## LARYNGOLOGICAL AND RHINOLOGICAL CLINICS

COMMITTEE FREDERICK MENGE, Chairman, WM. I. BALLENGER, and JOHN EDWIN RHODES

*Monday, November 10th*

STANTON A. FRIEDBERG — Cook County Hospital — 2 to 4  
 CHARLES M. ROBERTSON — Polyclinic Hospital — 2 to 5  
 P. J. H. FARRELL — St. Joseph's Hospital — 3 to 5

*Tuesday, November 11th*

JOSEPH C. BECK — Cook County Hospital — 3 to 6  
 OTTO T. FREER — Polyclinic Hospital — 4 to 5  
 CHARLES H. LONG — Post-Graduate Hospital — 8 to 12  
 P. J. H. FARRELL — Sheridan Park Hospital — 4 to 5

*Wednesday, November 12th*

D. B. HAYDEN — Central Free Dispensary — 2 to 4  
 BURTON HASLITINE — Hahnemann Hospital — afternoon  
 OTTO T. STEIN — Post Graduate Hospital — 2 to 5  
 FREDERICK MENGE — Wesley Hospital — 8 to 12  
 R. H. GOOD — Frances Willard Hospital — 3

*Thursday, November 13th*

JOSEPH C. BECK — Cook County Hospital — 3 to 6  
 RICHARD H. BROWN — College of P. and S. — 9 to 11  
 CHARLES M. ROBERTSON — Polyclinic Hospital — 2 to 5  
 CHARLES H. LONG — Post-Graduate Hospital — 8 to 12  
 P. J. H. FARRELL — St. Joseph Hospital — 3 to 5

*Friday, November 14th*

D. B. HAYDEN — Central Free Dispensary — 2 to 4  
 STANTON A. FRIEDBERG — Cook County Hospital — 2 to 4  
 OTTO T. FREER — Polyclinic Hospital — 4 to 5  
 WM. I. BALLENGER — College of P. and S. — 10 to 12  
 GEORGE E. SHAMBAUGH — Rush Medical College, Senn Hall — 2 to 4  
 P. J. H. FARRELL — Sheridan Park Hospital — 2 to 4

*Saturday, November 15th*

GEORGE W. BOOT — Children's Memorial Hospital — 1 to 3  
 JOSEPH C. BECK — Cook County Hospital — 3 to 6  
 CHARLES H. LONG — Post-Graduate Hospital — 8 to 12  
 ARTHUR M. CORWIN — West Side Hospital — 8.30.

*Days and Hours to be Announced Later*

GEORGE W. BOOT — Cook County Hospital  
 FRANK E. BRAWLEY — St. Luke's Hospital  
 J. T. CAMPBELL — Post Graduate Hospital  
 G. J. DENNIS — Wesley Hospital  
 MORTIMER FRANK — Michael Reese Hospital  
 T. M. HARDIE — St. Luke's Hospital  
 J. HOLINGER — St. Elizabeth's Hospital  
 E. F. INGALLS  
 HARRY KAHN — Michael Reese Hospital  
 O. H. MACLAY — Wesley Hospital  
 GEORGE P. MARQUIS — St. Luke's Hospital  
 JOHN E. RHODES — Presbyterian Hospital  
 ROBERT SONNENSCHN — Rush Medical College  
 C. B. YOUNGER — Wesley Hospital

## OPHTHALMOLOGICAL CLINICS

COMMITTEE WM. H. WILDER, Chairman, EDWARD V. L. BROWN and CASSIUS D. WESTCOTT

## Monday, November 10th

WILLIS O'NANCE—Illinois Charitable Eye & Ear Infirmary—2:30  
 G. W. MAHONEY—Polyclinic Hospital—9  
 W. FRANK COLEMAN—Post-Graduate Hospital—4  
 WILLIAM H. WILDER—Rush Medical College—2:30

## Tuesday, November 11th

CHARLES H. BEARD—Illinois Charitable Eye & Ear Infirmary—2:30  
 ALFRED N. MURRAY—Lake View Hospital—7  
 CHARLES H. FRANCIS—Polyclinic Hospital—9  
 GEORGE F. SUKLER—Post-Graduate Hospital—2

## Wednesday, November 12th

J. H. LORING—College of P. and S.—3  
 OSCAR DODD—Illinois Charitable Eye & Ear Infirmary—2:30  
 S. MEAD HAGER—Polyclinic Hospital—9  
 W. FRANK COLEMAN—Post-Graduate Hospital—9  
 GEORGE F. SUKLER—Post-Graduate Hospital—2

## Thursday, November 13th

WM. H. WILDER—Illinois Charitable Eye & Ear Hospital—2:30  
 G. W. MAHONEY—Polyclinic Hospital—9

## Friday, November 14th

H. W. WOODRUFF—Illinois Charitable Eye & Ear Hospital—2:30  
 ALFRED N. MURRAY—Lake View Hospital—10  
 CHARLES H. FRANCIS—Polyclinic Hospital—9  
 WILLIAM COLEMAN—Post-Graduate Hospital

## Saturday, November 15th

EDWARD V. L. BROWN—Illinois Charitable Eye & Ear Hospital—2:30  
 S. MEAD HAGER—Polyclinic Hospital—9  
 GEORGE F. SUKLER—Post-Graduate Hospital—2

## Days and Hours to be Announced Later

C. KURTZ FELLOWS—Hahnemann Hospital  
 ROBERT L. FRANK—Mercy Hospital  
 MORRIS L. FRANK—Michael Reese Hospital  
 E. J. SNYDER—Michael Reese Hospital  
 BROWN LEE—Northwestern University and Hospital  
 CASEY A. WOOD—St. Luke's Hospital  
 FRANK ALPORT—St. Luke's Hospital  
 CASSIUS D. WESTCOTT—St. Luke's Hospital  
 WM. L. GAMBLE—University Hospital

## OTOLOGICAL CLINICS

COMMITTEE NORVAL H. PIERCE, Chairman J. HOLINGER and GEORGE J. SHRAMBACH

## Monday, November 10th

IRA FRANK—Michael Reese Hospital—9  
 JOSEPH BECK—North Chicago Hospital—3 to 6  
 J. GORDON WILSON—Northwestern University Medical School—10  
 J. HOLINGER—St. Joseph's Hospital—9  
 T. MELVILLE HARDIE—St. Luke's Hospital

## Tuesday, November 11th

JOSEPH BECK—County Hospital—3 to 6  
 H. H. BOETTCHER—Illinois Eye and Ear Infirmary—2  
 DAVID FISKE—Polyclinic—2:30  
 FRANK ALLPORT—St. Luke's Hospital—2 General eye, ear, nose and throat clinic

## Wednesday, November 12th

J. HOLINGER—Alexian Brothers Hospital—9  
 JOHN A. CAVANAUGH—Chicago Eye, Ear, Nose and Throat Hospital—3 to 6  
 NORVAL H. PIERCE—Illinois Eye and Ear Infirmary—2  
 JOSEPH BECK—North Chicago Hospital—3 to 6  
 O. J. STEIN—Post-Graduate Medical School—afternoon  
 FRANK ALLPORT—St. Luke's Hospital—2 General eye, ear, nose and throat clinic

## Thursday, November 13th

DAVID FISKE—Children's Memorial Hospital—1 to 3  
 JOSEPH BECK—Cook County Hospital—2 to 4

ALFRED LEWIS—Hahnemann Hospital—2:30  
 CHARLES M. ROBERTSON—Polyclinic—2:30  
 IRA FRANK—Michael Reese Hospital—9  
 J. HOLINGER—St. Joseph's Hospital—9  
 A. H. ANDERSON—Wesley Hospital—morning

## Friday, November 14th

W. A. BATTINGER—College of P. & S.—10 to 1  
 H. H. BOETTCHER—Illinois Eye and Ear Infirmary—2  
 JOSEPH BECK—North Chicago Hospital—3 to 6  
 DAVID FISKE—Polyclinic—2:30  
 GEORGE J. SHRAMBACH—Rush Medical College—2 to 4  
 FRANK ALLPORT—St. Luke's Hospital—2 General eye, ear, nose and throat clinic

## Saturday, November 15th

J. HOLINGER—Alexian Brothers Hospital—9  
 JOSEPH BECK—Chicago Eye, Ear, Nose and Throat Hospital—3 to 6  
 JOHN A. CAVANAUGH—Chicago Eye, Ear, Nose and Throat Hospital—3 to 6  
 GEORGE W. BOOT—Children's Memorial Hospital—2:30  
 NORVAL H. PIERCE—Illinois Eye and Ear Hospital—2  
 J. GORDON WILSON—Northwestern University Medical School—10

